

**Mechanical Technology**

**Engines and Vehicles**

Department	Mechanical Technology	Major	Engines and Vehicles
<p><b>Program Description:</b></p> <p>This program has been designed to meet the training needs of the local labor market by taking into considerations the National Occupational Skill Standards (NOSS) for Automotive First Mechanic Trade. The training in this program includes general skills in the following areas; English Language, Mathematics, Physics, as well as Human Communication Skills. Also, the program includes training on basic skills related to automotive parts and systems and their operation, and the fundamentals of automotive electrics and electronic systems that would help the trainees in their careers. In addition, the program provides specialized skills in the field of engine and vehicle mechanics related to maintenance and repair techniques of automotive mechanical components and systems after performing a set of technical tests on vehicles. The training on how to set diagnostic strategies for mechanical faults in vehicles would also be given.</p> <p>In Technical Colleges, training in the major of “Engine and Vehicle Technology” is performed through 1677 contact hours, in addition to 420 hours of cooperative-training in the actual labor market through cooperation between the colleges and industrial establishments, and governmental and private sectors (like automotive agencies) that work fully or partly in the automotive field. The graduates of this program are awarded an associate degree certificate, and expected to work in civil and military establishments linked to the automotive field as Automotive First Mechanics.</p>			
<p><b>General Objective:</b></p> <p>This program aims at giving the trainees hands on skills and experience and the necessary information required exercising work in the field of engines and vehicles as Automotive First Mechanics on the fourth scale of the National Vocational Occupation System.</p>			
<p><b>Detailed Objectives:</b></p> <p><b>By the end of this program the trainees will be able to perform the following effectively:</b></p> <ol style="list-style-type: none"> <li>1) Follow safety procedures and instructions within automotive shops before the commencement of any job appointed to him.</li> <li>2) Describe basic vehicle systems, their components, functions, and methods of operation.</li> <li>3) Use different specialized equipments in the automotive field to perform necessary tests on vehicle components and systems.</li> <li>4) Use maintenance and service manuals of different vehicle models and deals with automotive spare parts.</li> <li>5) Execute maintenance and repair operations on vehicle systems and components with the related skills of assembly and disassembly.</li> <li>6) Set up diagnostic strategies for the mechanical faults in vehicle systems and components.</li> <li>7) Recognize technical terms in the field of engine and vehicle mechanics.</li> <li>8) Deal with new technologies that might emerge in different vehicle systems.</li> </ol>			

	No	Course Code	Course Title	Pre-requisite	Units No				
					C.U.	L	W	T	C. H.
First Trimester	1	ISL 101	Islamic Culture -1		2	2			2
	2	ARB 101	Arabic Language		2	2			2
	3	ENG 106	General English Language		4	4		2	6
	4	MAT 113	General Mathematics		4	4			4
	5	CMP 101	Introduction to Computer		2		4		4
	6	PHY 115	General Physics		3	3		1	4
	7	VOC 107	Vocational Guidance and Excellence		2	2			2
Sum					19	17	4	3	24

	No	Course Code	Course Title	Pre-requisite	Units No				
					C.U.	L	W	T	C.H.
Second Trimester	1	ENG 194	Technical English -1	ENG 106	4	4		2	6
	2	MAT 116	Specialized Mathematics	MAT113	3	3		1	4
	3	PHY 116	Specialized Physics	PHY 115	2	2		2	4
	4	ISL 102	Islamic Culture -2	ISL 101	2	2			2
	5	MEV 161	Workshop Principles		1		2		2
	6	MEV 162	Automotive Shop Safety		1		2		2
	7	MEV 163	Automotive Technology Principles		1		2		2
	8	MEV 164	Engineering Drawing		2		4		4
Sum					16	11	10	5	26

Third Trimester	No	Course Code	Course Title	Pre-requisite	Units No				
					C.U.	L	W	T	C.H.
	1	ENG 294	Technical English -2	ENG 194	4	4		2	6

	2	MEV 171	Automotive Electrical & Electronic Principles	PHY 116	4	3	2		5
	3	MEV 172	Automotive Engines	MEV163	5	3	4		7
	4	MEV 173	Power Transmission Systems	MEV 163	4	2	4		6
	5	MEV 174	Technical Drawings	MEV 164	2		4		4
Sum					19	12	14	2	28

	No	Course Code	Course Title	Pre-requisite	Units No				
					C.U.	L	W	T	C.H.
Fourth Trimester	1	MEV 251	Brake Systems	MEV163	4	2	4		6
	2	MEV 252	Ignition Systems	MEV 171 MEV 172	3	2	2		4
	3	MEV 253	Fuel Systems (Gasoline)	MEV 172	4	2	4		6
	4	MEV 254	Suspension and Steering Systems	MEV 163	4	2	4		6
	5	MGT 101	Professional Ethics and Communication Skills		2	2			2
Sum					17	10	14		24

	No	Course Code	Course Title	Pre-requisite	Units No				
					C.U.	L	W	T	C.H.
Fifth Trimester	1	MEV 261	Fuel Systems (Diesel)	MEV 172	3	2	2		4
	2	MEV 262	Automatic Transmissions	MEV 173	5	2	6		8
	3	MEV 263	Automotive Engines Repair	MEV 172	4	1	6		7
	4	MEV 264	Automotive Fault diagnostics	MEV 172	5	2	6		8
Sum					17	7	20		27

	No	Course Code	Course Title	Pre-requisite	Units No				
					C.U.	L	W	T	C.H.
Sixth Trimester	1	MEV 299	Cooperative Training		4	At Least 420 hours			

Total Sum					Units No				
					C.U.	L	W	T	C.H.
					92	57	62	10	129

Program's Total Contact Hours (1677 + 420)								2097
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**C.U:** Credit Hours

**L:** Lecture

**W:** Workshop

**T:** Tutorial

**C.H:** Contact Hours

Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Workshop Principles	Code	161 MEV					
Prerequisite	None							
<b>Course description:</b> This practical training course gives the trainees the basic skills in the area of preparatory workshops. The trainees will be prepared to perform measurements on work pieces, as well as perform manual cuttings, metal forming and joining, with the fundamentals of operations of tools and equipments in workshop.								
		Trimester		1	2	3	4	5
		Credit hours			1			
		Contact hours (hour/week)	L		-			
			W		2			
		T		-				
<b>General course objective:</b> This course aims at giving the trainees basic technical skills in the fields of dimension measurements, manual cutting, metal forming operations, and the use of tools and equipments in the workshop.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b>First: Procedural Objectives:</b> <b>The trainees should be able to:</b>								
1) Read technical drawings and execute required jobs on work pieces.		Execution of required job on work pieces according to technical drawings			A3			
2) Use measuring tools and execute measurements accurately.		Writing measurements on special models and compare to original ones			A3			
3) Correctly use hand tools and execute (chisel hand cutting-sawing-filing-screw cutting-hand shearing-manual pending)		Correct use of saw, file, scissor, and bending			A3			

4) Know the operation of the drill and its components and execute work using drills.	Execution of drilling operations on work pieces in the specified locations without deviation	<b>A4</b>
5) Know the safety rules when dealing with machine tools.	Wearing of protective eyeglasses and specified work clothes	<b>A1</b>
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Read technical drawings.	Read technical drawings according to measurements and abbreviations in work sheet	<b>A3</b>
2) Use hand measuring tools.	Use of hand tools correctly	<b>A3</b>
3) Hold hand tools correctly.	Ability to work with hand tools correctly	<b>A3</b>
4) Use drill to drill work pieces in specified places.	Drilling of work pieces in specified locations	<b>A4</b>
<b>Safety Requirements:</b> Compliance with safety rules and instructions given in the specification catalogues attached with hand tools, benders, and drilling equipments etc.		
Subjects (Theoretical and Practical)	Related Tasks	
• Operation principles of tools, equipment, and machines	<b>A4</b>	Identify tools and equipment, and method of using them, and operate the machines in workshop.
• Measurements of lengths	<b>A3</b>	Measure lengths
• Marking of work pieces	<b>A3</b>	Mark work piece
• Hand cutting by chisels	<b>A3</b>	Cut work piece by chisel
• Manual sawing	<b>A3</b>	Saw metal work piece
• Filing	<b>A3</b>	File metal work piece
• Drilling and hole finish	<b>A4</b>	Drill work piece sand finish holes
• Cutting threads	<b>A3</b>	Use threading tap and die

- Metal cutting and bending

A3

Cut metal by scissor and bend it using hand bender

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Operation principles of tools and equipments:</b> <ul style="list-style-type: none"> <li>- Safety rules in workshop</li> <li>- Types of tools and equipment</li> <li>- Equipment operation</li> <li>- All shapes and sizes of wrenches and pullers</li> <li>- Heavy machineries (turning machines for valves, cylinders, drums .... etc)</li> </ul>	Direct observation (practical performance) Oral questions
4	<b>Measurement of lengths:</b> <ul style="list-style-type: none"> <li>- Reading dimensions from technical drawings</li> <li>- Measurements using vernier calipers (universal-heights)</li> <li>- Marking work pieces (transfer dimensions into work piece)</li> <li>- Marking tools (steel ruler – marking fork – compass – punch)</li> <li>- Supporting surfaces</li> </ul>	
4	<b>Manual cutting using chisels( principles of cutting):</b> <ul style="list-style-type: none"> <li>- Hand sawing</li> <li>- Cutting using hacksaw</li> <li>- Using grinder</li> </ul>	
4	<b>Filing:</b> <ul style="list-style-type: none"> <li>- Identification of files parts and classifications</li> <li>- Using of vise</li> <li>- Surface leveling</li> <li>- Orthogonal surfaces</li> <li>- Surface finishing</li> </ul>	
4	<b>Drilling and hole finishing:</b> <ul style="list-style-type: none"> <li>- Threaded holes</li> <li>- Holding work piece and cutting tool</li> <li>- Chamfering</li> <li>- Granulation</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Manual thread cutting:</b> <ul style="list-style-type: none"> <li>- External threads (threading die)</li> <li>- Internal threads (threading tap)</li> </ul>	
4	<b>Metal forming and joining:</b> <ul style="list-style-type: none"> <li>- Bending</li> <li>- Cutting</li> <li>- Forming</li> <li>- Classifications of joints</li> <li>- Joint riveting</li> <li>- Joint welding</li> </ul>	Direct observation (practical performance) Oral questions

References:	<ol style="list-style-type: none"> <li>1- William H. Crouse and Donald L. Anglin, "Automotive Mechanics" The McGrawHill Book Company, ISBN 0-02-800943-6</li> <li>2- Jay Webster, Clifton E. Owen, "Basic Automotive Service &amp; Repair", Delmar Publishers, 2000, ISBN 0-8273-8544-7</li> <li>3- Don Knowles, "Automotive Technician Certification-Test Preparation Manual", Delmar Publishers, 2001, ISBN 0-7668-1948-5</li> <li>4- Martin, W. Stokel and Martin "Auto Mechanics Fundamentals", The GoodheartWillcox company, INC, ISBN 1-56637-138-4, 1996</li> <li>5- Stoekel, Stockel, and Johanson, "Auto Service &amp; Repair", The GoodheartWillcox company, INC, 1996, ISBN 1-56637-144-9</li> <li>6- Martin W. Stokel, Martin T. Stokel Cluis Johanson "Auto Fundamentals" The GoodheartWillcox company, INC, 1996, ISBN 1-56637-1384,</li> <li>7- William, K. Toboldt, Larry Johnson, and W. Scott Gavthier, "Automotive Encyclopedia" Fundamental, Principles, Operation, Construction, Service, and Repair-The Goodheart -Willcox company, 1995, INC, ISBN 1-56637-150-3</li> <li>8- Jack Enjavec "Automotive Technology", Delmar Publishers, 2000, ISBN 0-7668-0673-1</li> <li>9- Jack Enjavec, Robert Scharff, "Automotive Technology", Delmar Publishers, 1992, ISBN 0-8273-6724-4</li> <li>10- Robert Bosch GmbH "Automotive Handbook" Published by VDI-Verlag, 1996, ISBN 3-1-419115-X</li> </ol>
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|  | <ul style="list-style-type: none"><li><b>11- Duffy, James E., "Auto Engines" The Goodheart-Willcox company, INC, ISBN 0-87006A77-3</b></li><li><b>12- Martin W. Stockel, Martin T. Stockel, and Chris Johanson, "Auto Diagnosis, Service, and Repair", The Goodheart-Willcox Company, Inc., Tinley Park, Illinois, 2003, ISBN 1-56637-910-5</b></li><li><b>13- Crouse – Anglin, "Automotive Mechanics" - 10<sup>th</sup> Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6</b></li><li><b>14- William H. Crouse and Donald L. Anglin, "The Auto Book" – 3<sup>rd</sup> Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7</b></li><li><b>15- William H. Crouse and Donald L. Anglin, "Automotive Technician's Handbook", The McGraw-Hill Book Company, ISBN 0-07074751-5</b></li></ul> |
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Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Automotive Shop Safety	Code	162 MEV					
Prerequisite	None							
<b>Course description:</b> Auto shop safety is part of the job principles the trainees should know. This course covers methods of how to wear work clothes, safety gear, choosing and preparing the suitable workplace, methods of using tools and equipment and their safety, methods of using lifts, and maintaining safe environment inside the shop. The course also covers the proper methods of disposal of exhaust gases, storing of flammable materials and methods of using fire extinguishers.								
		Trimester		1	2	3	4	5
		Credit hours			1			
		Contact hours (hour/week)	L		-			
			W		2			
		T		-				
<b>General course objective:</b> The course aims at training trainees on how to follow safety rules and instructions in auto workshops that is part of job principles.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>								
1) Wear work clothes and safety gears.		- Correct methods of wearing work clothes and safety gears			A1			
2) Choose and prepare suitable work place		- Correct methods of choosing and preparing suitable work places			A2			
3) Use tools and equipment and know their safety and the method of using lifts		- Using tools, equipment, and lifts correctly			A3,A4,A5			
4) Maintain safe environment inside the work shop (appropriate method of exhaust gase disposal)		- Correct method of maintaining workshop and disposing exhaust gases			A6			
5) Store flammable materials and use fire extinguishers.		- Storing flammable materials and using fire extinguishers correctly			A7			

<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <ol style="list-style-type: none"> <li>1) Know methods of wearing work clothes and safety gears using visual or readable means.</li> <li>2) Determine suitable work place and prepare it.</li> <li>3) Use tools and equipment correctly, maintain their safety, and use lifts according to manufacturer instructions.</li> <li>4) Know method of keeping safe environment inside the workshop (suitable way of disposal of exhaust) through visual and readable means.</li> <li>5) Know method of disposal of flammable materials and method of using fire extinguishers through visual and readable means and field training.</li> </ol>	<ul style="list-style-type: none"> <li>- Description of method of wearing work clothes and safety gears</li> <li>- Determine suitable work place and ability to prepare it</li> <li>- Ability to use tools and equipment correctly, and ability to use lifts according to manufacturer instructions</li> <li>- Description of method of maintaining environment inside the workshop (suitable way of disposal of exhaust)</li> <li>- Description of method of removal of flammable materials and method of using fire extinguishers</li> </ul>	<p><b>A1</b></p> <p><b>A2</b></p> <p><b>A3,A4,A5</b></p> <p><b>A6</b></p> <p><b>A7</b></p>
<p><b>Safety Requirements:</b>  Compliance with safety rules and instructions given in the specification catalogues attached with hand tools, equipment, lifts, flammable materials, and fire extinguishers.</p>		
Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>• Method of wearing work clothes and safety gears</li> <li>• Method of choosing and preparing suitable work places</li> <li>• Methods of using tools and equipment and their safety, and method of using lifts</li> <li>• Methods of maintaining safe environment inside the workshop (suitable method of exhaust gases disposal)</li> </ul>	<b>A1</b>	- Wear work clothes
	<b>A2</b>	- Prepare workplaces
	<b>A3</b> <b>A4</b> <b>A5</b>	<ul style="list-style-type: none"> <li>- Use tools correctly</li> <li>- Use equipment correctly</li> <li>- Secure vehicle lift</li> </ul>
	<b>A6</b>	- Use exhaust gases suction pipes

<ul style="list-style-type: none"> <li>• Methods of removal of flammable materials</li> <li>• Method of using fire extinguishers</li> <li>• Apply manufacturer instructions related to safety</li> </ul>	<b>A7</b>	- Store flammable materials in suitable place
	<b>A8</b>	- Know how to use fire extinguishers
	<b>A9</b>	- Comply with manufacturer instructions related to safety

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Personal safety:</b> <ul style="list-style-type: none"> <li>- Meaning of professional safety:</li> <li>- Wearing work clothes and ensuring their specifications</li> <li>- Wearing safety glasses</li> <li>- Wearing gloves</li> <li>- First aids</li> </ul>	Direct observation (practical performance) Oral questions Written questions
2	<b>The place:</b> <ul style="list-style-type: none"> <li>- Choosing suitable place for work</li> <li>- Placing the vehicle in the right location for the job</li> <li>- Ensuring that the floor is free of any liquids spills</li> <li>- Ensuring the presence of safety means (fire exits, passage ways, fire extinguishers, sufficient lighting, ventilation)</li> </ul>	
4	<b>Dealing with the vehicle:</b> <ul style="list-style-type: none"> <li>- Follow manufacturer instructions</li> <li>- Placing protective covers on vehicles during work</li> <li>- Keeping vehicles safe during work</li> <li>- Personal safety when dealing with vehicles</li> </ul>	
2	<b>Using tools:</b> <ul style="list-style-type: none"> <li>- Identifying tools and using the suitable ones for the job</li> <li>- Taking care of the tools</li> </ul>	
4	<b>Equipment:</b> <ul style="list-style-type: none"> <li>- Correct methods of using equipment</li> <li>- Using the right device</li> <li>- Taking care of the equipment</li> <li>- Requirements when dealing with equipment</li> <li>- Requirements when dealing with electrical sources</li> </ul>	

4	<b>Lifts:</b> <ul style="list-style-type: none"> <li>- Identifying lifts and methods of using them</li> <li>- Proper placement of vehicles on the lift</li> <li>- Ensure vehicle stability on the lift and secure it</li> </ul>	Direct observation (practical performance) Oral questions Written questions
2	<b>Exhaust gases:</b> <ul style="list-style-type: none"> <li>- Ensure the operation of suction system of exhaust gases</li> <li>- Use exhaust gas suction pipes</li> </ul>	
4	<b>Flammable materials:</b> <ul style="list-style-type: none"> <li>- Store flammable materials in their designated places</li> <li>- Caution when carrying flammable materials</li> <li>- Ventilation of their storing area</li> <li>- Disposal of used materials (wastes)</li> <li>- Securing the closure of storing area</li> </ul>	
2	<b>Fire extinguishers:</b> <ul style="list-style-type: none"> <li>- Identification of types and methods of using fire extinguishers</li> <li>- Identification of the location of the fire extinguishers</li> <li>- Permanent revision of the validity of fire extinguishers</li> </ul>	

**References:**

- 1- William H. Crouse and Donald L. Anglin, "Automotive Mechanics" The McGrawHill Book Company, ISBN 0-02-800943-6
- 2- Jay Webster, Clifton E. Owen, "Basic Automotive Service & Repair", Delmar Publishers, 2000, ISBN 0-8273-8544-7
- 3- Don Knowles, "Automotive Technician Certification- Test Preparation Manual", Delmar Publishers, 2001, ISBN 0-7668-1948-5
- 4- Martin, W. Stokel and Martin "Auto Mechanics Fundamentals", The GoodheartWillcox company, INC, ISBN 1-56637-138-4, 1996
- 5- Stoekel, Stockel, and Johanson, "Auto Service & Repair", The GoodheartWillcox company, INC, 1996, ISBN 1-56637-144-9
- 6- Martin W. Stokel, Martin T. Stokel Cluis Johanson "Auto Fundamentals" The GoodheartWillcox company, INC, 1996, ISBN 1-56637-1384,
- 7- William, K. Toboldt, Larry Johnson, and W. Scott Gavthier, "Automotive Encyclopedia" Fundamental, Principles, Operation, Construction, Service, and Repair- The Goodheart -Willcox company, 1995, INC, ISBN 1-56637-150-3
- 8- Jack Enjavec "Automotive Technology", Delmar Publishers, 2000, ISBN 0-7668-0673-1
- 9- Jack Enjavec, Robert Scharff, "Automotive Technology", Delmar Publishers, 1992, ISBN 0-8273-6724-4
- 10- Robert Bosch GmbH "Automotive Handbook" Published by VDI-Verlag, 1996, ISBN 3-1-419115-X
- 11- Duffy, James E., "Auto Engines" The GoodheartWillcox company, INC, ISBN 0-87006A77-3
- 12- Martin W. Stockel, Martin T. Stockel, and Chris Johanson, "Auto Diagnosis, Service, and Repair", The Goodheart-Willcox Company, Inc., Tinley Park, Illinois, 2003, ISBN 1-56637-910-5
- 13- Crouse – Anglin, "Automotive Mechanics" - 10<sup>th</sup> Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6
- 14- William H. Crouse and Donald L. Anglin, "The Auto Book" – 3<sup>rd</sup> Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7
- 15- William H. Crouse and Donald L. Anglin, "Automotive Technician's Handbook", The McGraw-Hill Book Company,

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Course name	Automotive Technology Principles	Code	163 MEV					
Prerequisite	None							
<b>Course description:</b> In this course, the trainees will be trained on all vehicle systems that include the engine, different power transmission systems, suspension and steering, and the brakes.								
		Trimester		1	2	3	4	5
		Credit hours			1			
		Contact hours (hour/week)	L		-			
			W		2			
		T		-				
<b>General course objective:</b> This course aims at introducing the trainees to different vehicle systems.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Recognize vehicle classifications and specifications.  2) Recognize engines, parts and related systems.  3) Recognize power transmission systems, their types, and components.  4) Recognize suspension systems, their types, and components.		<ul style="list-style-type: none"><li>- Classification of vehicles and naming of their specifications</li><li>- Classification of engines and state of engine components</li><li>- Naming components of engine systems</li><li>- Classification of power transmission systems</li><li>- Naming components of all power transmission systems</li><li>- Classification of suspension systems</li><li>- Naming suspension systems components</li></ul>			<b>D1</b>  <b>D1, D4, D7, D8, D10, L1, L2, L3 E1, E8</b>  <b>G1, G11, G12, G13, G16</b>			
5) Recognize steering systems, their types, and components.					<ul style="list-style-type: none"><li>- Classification of steering systems</li><li>- Naming steering systems</li></ul> <b>G3, G6, G7, G8, G15</b>			

<p>6) Recognize hydraulic brake systems, their types, and components.</p> <p>7) Recognize vehicle accessories.</p>	<p>components</p> <ul style="list-style-type: none"> <li>- Classification of hydraulic brake systems</li> <li>- Naming brake systems components</li> <li>- Naming some of the vehicle accessories</li> </ul>	<p><b>F4, F5, F6, F7, F8, F9, F10</b></p>
<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <p>1) Know vehicle specifications and classifications through visual or readable means.</p> <p>2) Know engines, parts and related systems theoretically through visual or readable means and practically inside auto shops.</p> <p>3) Know power transmission systems, their types, and components theoretically through visual or readable means and practically inside auto shops.</p> <p>4) Know suspension systems, their types, and components theoretically through visual or readable means and practically inside auto shop</p> <p>5) Know steering systems, their types, and components theoretically through visual or readable means and practically inside auto shops.</p>	<ul style="list-style-type: none"> <li>- Determination of Vehicle specifications and classifications</li> <li>- Classification of engines exist in the automotive shop</li> <li>- Determination of engine parts</li> <li>- Identification of related engine systems and naming their parts</li> <li>- Classification of power transmission systems exist in the auto shop</li> <li>- Determination of components of different power transmission systems</li> <li>- Classification of suspension systems exist in the auto shop</li> <li>- Determination of components of different suspension systems</li> <li>- Classification of steering systems exist in the auto shops</li> <li>- Determination of components of different steering systems</li> </ul>	<p><b>D1</b></p> <p><b>D1, D4, D7, D8, D10, L1, L2, L3</b></p> <p><b>E1, E8</b></p> <p><b>G1, G11, G12, G13, G16</b></p> <p><b>G3, G6, G7, G8, G15</b></p>
<p>6) Know hydraulic brake systems, their types, and components theoretically through visual or readable means and practically inside auto shops.</p>	<ul style="list-style-type: none"> <li>- Classification of hydraulic brake systems exist in the auto shop</li> <li>- Determination of components</li> </ul>	<p><b>F4, F5, F6, F7, F8, F9, F10</b></p>

<p>7) Know vehicle accessories theoretically through visual or readable means and practically inside auto shops.</p>	<p>of different brake systems</p> <ul style="list-style-type: none"> <li>- Determination of vehicle accessories</li> </ul>	
<p><b>Safety Requirements:</b> Compliance with safety instructions found in automotive shops.</p>		
Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Vehicle classifications and specifications</li> <li>- Engines, parts and related systems</li> <li>- Power transmission systems, their types, and components</li> <li>- Suspension systems, their types, and components</li> <li>- Steering systems, their types, and components</li> </ul>	<p><b>D1, D4, D7, D8, D10, L1, L2, L3</b></p>	<ul style="list-style-type: none"> <li>- Ensure that the engine reaches its working temperature</li> <li>- Inspect cooling system</li> <li>- Check lubrication system</li> <li>- Check fuel system</li> <li>- Check ignition system</li> <li>- Check battery voltage</li> <li>- Test basic car electrical circuits</li> <li>- Test basic car electrical circuits</li> </ul>
	<p><b>E1, E8</b></p>	<ul style="list-style-type: none"> <li>- Determine type of transmission</li> <li>- Check differential gears</li> </ul>
	<p><b>G1, G11, G12, G13, G16</b></p>	<ul style="list-style-type: none"> <li>- Identify the type of suspension system (hydraulic, air mechanical)</li> <li>- Check shock absorbers</li> <li>- Check suspension arms and joints</li> <li>- Check leaf and coil springs</li> <li>- Check pump and hydraulic suspension system</li> </ul>
	<p><b>G3, G6, G7, G8, G15</b></p>	<ul style="list-style-type: none"> <li>- Check steering gear box</li> <li>- Check steering wheel</li> <li>- Check power steering pump and belt</li> <li>- Check steering linkage</li> <li>- Check stabilizer bar</li> </ul>

<ul style="list-style-type: none"> <li>- Hydraulic brake systems, their types, and components</li> </ul>	<b>F4, F5, F6, F7, F8, F9, F10</b>	<ul style="list-style-type: none"> <li>- Check brake friction materials (pads and lining)</li> <li>- Check discs and drums of the brakes</li> <li>- Check brake booster</li> <li>- Check anti-lock brake system (ABS)</li> <li>- Check parking brakes</li> <li>- Check master and wheel cylinders</li> <li>- Check brake pedal</li> </ul>
<ul style="list-style-type: none"> <li>- Vehicle accessories</li> </ul>		

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Vehicle specifications and classifications:</b> <ul style="list-style-type: none"> <li>- History of motor vehicles</li> <li>- Types of internal combustion engines</li> <li>- Main components of the engine</li> <li>- The four stroke cycle</li> <li>- Design characteristics of the engine</li> </ul>	Direct observation (practical performance) Written questions Oral questions
8	<b>The engine:</b> <ul style="list-style-type: none"> <li>- Engine classifications</li> <li>- Engine systems:               <ul style="list-style-type: none"> <li>- Cooling system (radiator, hoses, water pump, water jacket)</li> <li>- Lubrication system (oil pan, oil pump, oil passages, oil filter)</li> <li>- Fuel system: Conventional system (tank, fuel pump, fuel filter, hoses, carburetor) - Fuel injection system ( tank, fuel pump, connections, fuel filter, control unit, injectors)</li> <li>- Ignition systems (battery, ignition coil, distributor, spark plugs)</li> <li>- Charging systems</li> <li>- Starting systems</li> <li>- Exhaust systems</li> </ul> </li> </ul>	
4	<b>Power transmission systems, types and components:</b> <ul style="list-style-type: none"> <li>- Friction clutches, different types</li> <li>- Sliding and constant mesh gear boxes</li> <li>- Automatic transmission</li> <li>- Different types of propeller shafts, joints, and bearings</li> <li>- Differential, components, and its importance</li> <li>- Drive shafts and axles</li> </ul>	
2	<b>Suspensions:</b> <ul style="list-style-type: none"> <li>- Springs and shock absorbers</li> <li>- Suspension arms, bars, rubber bushings, and roller bearings</li> <li>- Tyres and Drums</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Steering:</b> <ul style="list-style-type: none"> <li>- Types and components of conventional steering system</li> <li>- Types and components of power steering system</li> <li>- Wheel alignment angles, types and their importance</li> <li>-</li> </ul>	Direct observation (practical performance) Written questions Oral questions
4	<b>Brakes, types and components:</b> <ul style="list-style-type: none"> <li>- Hydraulic brakes (drum and disc brakes)</li> <li>- Brake booster, levers, connections, parking brakes, and engine brake</li> <li>- Anti-lock brake circuit (ABS)</li> </ul>	
4	<b>Vehicle accessories:</b> <ul style="list-style-type: none"> <li>- Comfort systems</li> <li>- Safety and protection circuits</li> <li>- Electrical circuits ( front and rear lightening circuit, wipers, flashers, ....etc)</li> </ul>	

**References:**

- 1- William H. Crouse and Donald L. Anglin, "Automotive Mechanics" The McGrawHill Book Company, ISBN 0-02-800943-6
- 2- Jay Webster, Clifton E. Owen, "Basic Automotive Service & Repair", Delmar Publishers, 2000, ISBN 0-8273-8544-7
- 3- Don Knowles, "Automotive Technician Certification- Test Preparation Manual", Delmar Publishers, 2001, ISBN 0-7668-1948-5
- 4- Martin, W. Stokel and Martin "Auto Mechanics Fundamentals", The GoodheartWillcox company, INC, ISBN 1-56637-138-4, 1996
- 5- Stoekel, Stockel, and Johanson, "Auto Service & Repair", The GoodheartWillcox company, INC, 1996, ISBN 1-56637-144-9
- 6- Martin W. Stokel, Martin T. Stokel Cluis Johanson "Auto Fundamentals" The GoodheartWillcox company, INC, 1996, ISBN 1-56637-1384,
- 7- William, K. Toboldt, Larry Johnson, and W. Scott Gavthier, "Automotive Encyclopedia" Fundamental, Principles, Operation, Construction, Service, and Repair- The Goodheart-Willcox company, 1995, INC, ISBN 1-56637-150-3
- 8- Jack Enjavec "Automotive Technology", Delmar Publishers, 2000, ISBN 0-7668-0673-1
- 9- Jack Enjavec, Robert Scharff, "Automotive Technology", Delmar Publishers, 1992, ISBN 0-8273-6724-4
- 10- Robert Bosch GmbH "Automotive Handbook" Published by VDI-Verlag, 1996, ISBN 3-1-419115-X
- 11- Duffy, James E., "Auto Engines" The GoodheartWillcox company, INC, ISBN 0-87006A77-3
- 12- Martin W. Stockel, Martin T. Stockel, and Chris Johanson, "Auto Diagnosis, Service, and Repair", The Goodheart-Willcox Company, Inc., Tinley Park, Illinois, 2003, ISBN 1-56637-910-5
- 13- Crouse – Anglin, "Automotive Mechanics" - 10<sup>th</sup> Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6
- 14- William H. Crouse and Donald L. Anglin, "The Auto Book" – 3<sup>rd</sup> Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7
- 15- William H. Crouse and Donald L. Anglin, "Automotive Technician's Handbook", The McGraw-Hill Book Company,

ISBN 0-07074751-5



Department	Mechanical Technology	Major	Engines and Vehicles																																				
Course name	Automotive Electrics & Electronic Principles	Code	171 MEV																																				
Prerequisite	116 PHY																																						
<b>Course description:</b> This course covers the study of the fundamentals of electricity and magnetism, and their applications on vehicle electrical and electronic circuits. The characteristics and operation of the elements of these circuits such as: resistors, capacitors, transistors, diodes...etc will be explained. In addition, the fundamentals and components of electronic control systems in vehicles including sensors, actuators, and control units will be covered. Also, the course provides the trainees with the operation principles of electrical and electronic testing equipment such as voltmeter, ammeter, millimeter, and oscilloscope. In the practical part, training on testing the operation of electrical and electronic circuits and their elements as well as inspecting, repairing and replacing basic electrical elements will be given.																																							
		<table><tr><td colspan="2">Trimester</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td colspan="2">Credit hours</td><td></td><td></td><td>4</td><td></td><td></td></tr><tr><td rowspan="3">Contact hours (hour/week)</td><td>L</td><td></td><td></td><td>3</td><td></td><td></td></tr><tr><td>W</td><td></td><td></td><td>2</td><td></td><td></td></tr><tr><td>T</td><td></td><td></td><td>-</td><td></td><td></td></tr></table>					Trimester		1	2	3	4	5	Credit hours				4			Contact hours (hour/week)	L			3			W			2			T			-		
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<b>General course objectives:</b> The course aims at giving the trainees basic skills to test electrical parts, and to get him familiar with modern vehicle electronic circuit components besides testing their parts, and performing inspections, repair, and replacement operations of basic vehicle electrical components.																																							
Detailed Objectives		Required Performance Specifications			Related Tasks																																		
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Follow safe procedure when dealing with electrical and electronic systems.  2) Describe operation of semiconductors, diodes, and transistors.		- Follow safety rules in dealing with safe way with electrical and electronic elements and apparatus  - Illustration of method of operation of electrical and electronic elements correctly			A4  F7, I6, I18																																		

3) Explain the function of electronic control system components including sensors, ECU, and actuators.	- Illustration of the function of electronic control system components correctly	<b>F7, I6, I18</b>
4) Recognize modern vehicle electronic circuit components.	- Determination of electronic system components correctly	<b>F7, I6, I18</b>
5) Test vehicle electrical and electronic components.	- Testing electrical and electronic components correctly	<b>L1..L3</b>
6) Perform checking, repair, and replacement of vehicle basic electrical components.	- Operation of electrical components with the required efficiency	<b>L4, L5</b>
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Apply basic electricity and magnetism laws on the electrical and electronic circuit components of vehicles.	- Apply Ohm, Linz, Faraday, Kerchief and Flemeng's laws on the electrical and electronic circuit components	<b>L1..L5</b>
<b>Safety Requirements:</b> <ul style="list-style-type: none"> <li>- Compliance with safety instructions given in the user manuals of testing equipment.</li> <li>- Compliance with safety instructions in electrical laboratories and workshops.</li> </ul>		
<b>Subjects (Theoretical and Practical)</b>	<b>Related Tasks</b>	
- Electrical principles	<b>L2</b>	- Test basic car electrical circuits
- Electronic components	<b>L3</b>	- Test basic car electrical components
- Principles of vehicle computer	<b>F7, I6, I18</b>	<ul style="list-style-type: none"> <li>- Check anti-lock brake system (ABS)</li> <li>- Replace transmission sensors</li> <li>- Replace axle sensors</li> </ul>
- Battery, starter, and alternator	<b>L1</b>	- Check battery voltage

<ul style="list-style-type: none"><li>- Principles of vehicle testing equipment</li><li>- Inspection, repair, and replacement of vehicle basic electrical parts</li></ul>	<b>B5, E7</b>	<ul style="list-style-type: none"><li>- Use test equipment to determine car fault</li><li>- Use testing equipment</li></ul>
	<b>L2, L3, L4, L5</b>	<ul style="list-style-type: none"><li>- Test basic car electrical circuits</li><li>- Test basic car electrical components</li><li>- Replace faulty electrical components</li><li>- Repair faulty electrical components</li></ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
6	<b>Electrical principles:</b> <ul style="list-style-type: none"> <li>- Introduction to Electricity and electrical laws</li> <li>- Basic electrical circuits (series, parallel, series-parallel)</li> <li>- Electrical circuit components (resistor, capacitor, coil, fuse ....etc)</li> <li>- Electrical symbols</li> <li>- Principles and applications of magnetic induction</li> <li>- Electro-magnetic induction</li> <li>- Application of electro-magnetic induction on the electric motor, generator, and transformer</li> </ul>	Written questions Oral questions Self test
4	<b>The battery:</b> <ul style="list-style-type: none"> <li>- Battery function</li> <li>- Battery capacity</li> <li>- Battery internal parts</li> <li>- Battery operation and connection to the vehicle</li> </ul>	
4	<b>Electronic components:</b> <ul style="list-style-type: none"> <li>- Semiconductors</li> <li>- Diodes</li> <li>- Zener diodes</li> <li>- Transistors</li> <li>- Fiber optics</li> <li>- Integrated circuits</li> </ul>	
4	<b>Vehicle engine starting systems:</b> <ul style="list-style-type: none"> <li>- Starter function</li> <li>- Starter parts</li> <li>- Method of operation of starting system</li> </ul>	
5	<b>Charging systems:</b> <ul style="list-style-type: none"> <li>- Function of charging system</li> <li>- Difference between generators and alternators</li> <li>- Types of alternators</li> <li>- Alternator parts, method of operation and method of voltage regulation</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
6	<b>Electrical and comfort circuits:</b> <ul style="list-style-type: none"> <li>- Lighting circuit in the vehicle</li> <li>- Side and warning light signal circuit</li> <li>- Horn circuit</li> <li>- Vehicle speed indicator</li> <li>- Door central lock</li> <li>- Electric windows</li> <li>- Wiper screen</li> <li>- Speed holding system</li> <li>- Seat adjustment</li> </ul>	Written questions Oral questions Self test
10	<b>Vehicle computer principles:</b> <ul style="list-style-type: none"> <li>- Control circuit components (inputs, control units, outputs)</li> <li>- Basic principles of electronic data processing in vehicle computer</li> <li>- Sensors: types and functions</li> <li>- Input stages in control unit (wave form, A/D converter)</li> <li>- Microcomputer <ul style="list-style-type: none"> <li>- I/O unit</li> <li>- Clock generator</li> <li>- Bus</li> <li>- CPU</li> <li>- ALU</li> <li>- ROM and RAM</li> </ul> </li> <li>- Output stages in control unit (signal magnification)</li> <li>- Types and functions of actuators</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Electrical principles:</b> <ul style="list-style-type: none"> <li>- Safety instructions in automotive electrical shops</li> <li>- Verification of basic electrical laws (Ohm's, Kirchhoff's, ...etc)</li> <li>- Types of electrical circuits (series, parallel, series-parallel)</li> <li>- Measurements of volt, current, and power of electrical circuits using electrical test instruments and the application of that on vehicle electrical circuits</li> </ul>	Direct observation (practical performance) Oral questions
2	<b>Battery maintenance and testing:</b> <ul style="list-style-type: none"> <li>- Battery maintenance</li> <li>- Battery removal, cleaning, and reinstalling</li> <li>- Testing of density</li> <li>- Battery voltage testing</li> <li>- Battery servicing</li> </ul>	
4	<b>Electrical and electronic circuit component testing:</b> <ul style="list-style-type: none"> <li>- Resistors</li> <li>- Circuit breakers</li> <li>- Capacitors</li> <li>- Relays</li> <li>- Electromagnetic switches (solenoids)</li> <li>- Diodes</li> <li>- Transistors</li> <li>- Thyristors</li> <li>- Checking electrical circuits (intact, open, or short)</li> <li>- Indicators and warning devices</li> </ul>	
2	<b>Starting system testing:</b> <ul style="list-style-type: none"> <li>- Components of starter circuit</li> <li>- Checking starting circuit components</li> <li>- Testing of starter motor on the vehicle</li> <li>- Disassemble starter motor</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Charging circuit testing:</b> <ul style="list-style-type: none"> <li>- Charging circuit components</li> <li>- Maintenance and servicing of charging system</li> <li>- Checking charging circuit</li> <li>- Replacement of alternator</li> </ul>	Direct observation (practical performance) Oral questions
4	<b>Testing and replacing of electrical and comfort circuit components:</b> <ul style="list-style-type: none"> <li>- Lighting circuit in the vehicle</li> <li>- Side and warning light signal circuit</li> <li>- Horn circuit</li> <li>- Vehicle speed indicator</li> <li>- Door central lock</li> <li>- Electric windows</li> <li>- Wiper screen</li> <li>- Speed holding system</li> <li>- Seat adjustment</li> <li>-</li> </ul>	
4	<b>Principles of operation of vehicle test equipment:</b> <ul style="list-style-type: none"> <li>- types and principle of operation of digital multimeters</li> <li>- types and operation principles of engine analyzers and testing equipment</li> </ul>	
4	<b>Electronic control circuits:</b> <ul style="list-style-type: none"> <li>- Components of vehicle electronic control circuits with the presentation of some examples such as ignition control systems, ABS, and engine management systems</li> <li>- Component of the control units</li> </ul> <b>Vehicle computer systems:</b> <ul style="list-style-type: none"> <li>- Follow safe procedure in dealing with vehicle computers</li> <li>- Checking electrical connections of computer system</li> <li>- Testing some vehicle electronic system sensors (active and passive):               <ul style="list-style-type: none"> <li>- Use of digital multi-meter to measure output voltage, resistance and current and compare with</li> </ul> </li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"><li>specifications<ul style="list-style-type: none"><li>- Measurement of reference voltage</li></ul></li><li>- Testing different types of actuators, using electrical testing equipment:<ul style="list-style-type: none"><li>- Solenoids, relay, servo motor</li><li>- Measurement of actuator internal resistance and compare with specifications</li></ul></li><li>- Measurement of computer output voltage using digital multi-meter:<ul style="list-style-type: none"><li>- Measurement of reference voltage to sensors</li><li>- Measurement of current or operating voltage of actuators</li><li>- Comparing results with manufacturer's data</li></ul></li><li>- Disassemble and replacement of programmable read only memory (PROM)</li></ul>	<p>Direct observation (practical performance) Oral questions</p>



**References:**

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- 2- James E. Duffy, "Auto Electricity, Electronics, Computers", The Goodheart-Willcox Company Inc.
- 3- James E. Duffy, "Modern Automotive Technology" The Goodheart-Willcox Company Inc., ISBN 0-87006-043-0, 1994.
- 4- Stockel, and Johanson, "Auto Service and Repair", The Goodheart-Wilcox Company Inc., ISBN 1-56637-144-9
- 5- John Deere, "Electrical Systems, Fundamentals of Service&', ISBN 0-8669 1-0476
- 6- William Toboldt, Larry Johnson and W. Scott Gauthier, "Automotive Encyclopedia", 1995, The Goodheart-Wilcox Company Inc., ISBN
- 7- Harcourt Brace Jovanivich, "Automotive computer control systems", Fundamentals and services, Publishers, ISBN 0-15-504355-2
- 8- Robert Bosch GmbH, "Automotive Handbook", ISBN 0-89 283-518-6
- 9- Harper and Row, "Automotive Electrical Systems", Classroom Manual, Check-Chart Automotive Series
- 10- Harper and Row, "Automotive Electrical Systems", Workshop Manual, Check-Chart Automotive Series
- 11- Martin W. Stockel and Martin T. Stockel, "Auto Fundamentals", The Goodheart-Wilcox Company Inc.
- 12- Robert Bosch Coop, "Bosch Technical Instruction Series",
  - Engine Electronics
  - Alternators
  - Starting Systems
- 13- Robert Bosch Coop, "Automotive Handbook", Bosch, VDI-Verlag, ISBN
- 14- Robert Bosch Coop, "Fault Detection with Oscilloscope", ISBN 1-689-9804-86

Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Engineering Drawing	Code	164 MEV					
Prerequisite	None							
<b>Course description:</b> This course includes training on the basics of engineering drawing, the method of using drawing tools, orthographic projection, conversions, symbols, sections and hatching. The course contains method of representing details of mechanical parts through engineering drawing by orthographic projection and sections. Identification of drawing symbols and terms will also be included.								
		Trimester		1	2	3	4	5
		Credit hours			2			
		Contact hours	L		-			
			W		4			
		T		-				
<b>General course objectives:</b> The course aims at providing the trainees with the skills to use engineering drawing as a language to be able to read drawings and understand symbols, it also prepares the trainees to correctly employ the basics and symbols of engineering drawings in representing details of mechanical parts.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Explain the meaning of different lines used in engineering drawing.  2) Identify different symbols used to transfer information.  3) Read and understand engineering drawing and printed sheets.  4) Analyze drawing and write technical reports.		 - Explanation of the meaning of different lines used in engineering drawing  - Identification of different symbols used to transfer information  - Read engineering drawing and printed sheets  - Analysis of drawing and writing of technical reports			<b>B6, E1, E8, E10, E11, E12, G13, H1, H2, I1, I14, I17, K7, K10</b>			
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>								

<ol style="list-style-type: none"> <li>1) Identify different types of drawing tools used in engineering drawing.</li> <li>2) Read some visual means and 3d AutoCAD computer drawings</li> <li>3) Identify some sections of automotive parts.</li> </ol>	<ul style="list-style-type: none"> <li>- Identification of types of drawing tools used in engineering drawing</li> <li>- Ability to differentiate between types of projections in engineering drawing</li> <li>- Comparison of real sectioned parts of automotive components with their technical drawings</li> </ul>	<b>B6, E1, E8, E10, E11, E12, G13, H1, H2, I1, I14, I17, K7, K10</b>
<b>Safety Requirements:</b> Compliance with safety instructions found in engineering drawing hall.		
Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Principles of engineering drawing</li> <li>- Orthographic projection</li> <li>- Symbols and terms</li> <li>- Sections and their types</li> </ul>	<b>E1, E8, E10, E11, E12, H2</b>	- Determine type of transmission
		- Check differential gears
		- Check drive axles
		- Check propeller shaft support bearings
		- Check universal joints
		- Check springs
		- Check fly wheel and replace the clutch

Detailed Practical Course		
Hours	Content	Evaluation Tools
8	<b>Principles of Engineering Drawing:</b> <ul style="list-style-type: none"> <li>- Engineering drawing as a language for technicians</li> <li>- Tools and equipment used</li> <li>- Types of lines</li> <li>- Methods of writing figures and numbers</li> <li>- Projection methods</li> <li>- Distribution of drawing sheet</li> <li>- Freehand drawing</li> <li>- Scale of drawing (enlargement / reduction)</li> </ul>	Direct observation (practical performance) Oral questions Written questions
12	<b>Orthographic projection:</b> <ul style="list-style-type: none"> <li>- Orthographic projection of points, lines and areas</li> <li>- Orthographic projection of the first angle</li> <li>- Projection symbols</li> <li>- Different view projections of bodies</li> <li>- Hidden details</li> <li>- Applications</li> </ul>	
8	<b>Dimensions:</b> <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Dimensions techniques</li> <li>- Reference and dimension lines</li> <li>- Arrow lines drawing</li> <li>- Methods of writing dimensions</li> <li>- Writing dimensions on circles (diameters and radii)</li> <li>- Applications</li> </ul>	
12	<b>Isometric drawing:</b> <ul style="list-style-type: none"> <li>- Methods of isometric representation</li> <li>- Representation of circling surfaces and holes</li> <li>- Applications</li> </ul>	
12	<b>Sections and sectioned shapes:</b> <ul style="list-style-type: none"> <li>- The need for sections</li> <li>- Section levels</li> <li>- Full section and half section</li> <li>- Broken out, revolved, removed, and partial section</li> <li>- Applications</li> </ul>	

**References:**

- 1- James H, "Drafting, technology,, Earle Addison-Wesley Publications co.**
- 2- M.A. Parker & L.J. Dennis, "Engineering drawing Fundamentals', Stanley Theories.**
- 3- 3- Warren J. Luzadder, „Fundamentals of Engineering Drawing', Prentice-Hall, 1986, Ninth Edition.**

Department	Mechanical Technology	Major	Engines and Vehicles																															
Course name	Automotive Engines	Code	172 MEV																															
Prerequisite	163 MEV																																	
<b>Course description:</b> This course provides the trainees with the basics of automotive engines and its operating systems, with the explanation of different types of engines, their systems and characteristics. The engine parts, characteristics of cooling systems, lubrication systems, emission control systems, and intake and exhaust systems will be explained. The trainees will be trained on how to deal with engine systems regarding inspection, adjustment, replacement, maintenance, and repair of units and parts while giving him the ability to follow up faults and repair it. The course provides an introduction that prepares the trainees to study specialized courses related to automotive engines.		<table><tr><td>Trimester</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Credit hours</td><td></td><td></td><td>5</td><td></td><td></td></tr><tr><td rowspan="3">Contact hours</td><td>L</td><td></td><td>3</td><td></td><td></td></tr><tr><td>W</td><td></td><td>4</td><td></td><td></td></tr><tr><td>T</td><td></td><td>-</td><td></td><td></td></tr></table>					Trimester	1	2	3	4	5	Credit hours			5			Contact hours	L		3			W		4			T		-		
Trimester	1	2	3	4	5																													
Credit hours			5																															
Contact hours	L		3																															
	W		4																															
	T		-																															
<b>General course objective:</b> This course aims at giving the trainees with the basic skills required to deal with automotive engines. It prepares him to perform adjustment and maintenance work on engine systems and circuits using theoretical information, technical books and catalogues, and gives him the skills to use engine tests and diagnostic equipment, and the skills of using tools and equipment in disassembling and assembling engine parts and systems.																																		
Detailed Objectives		Required Performance Specifications			Related Tasks																													
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Follow up safety instructions in engine workshops.  2) Identify engines and their operating systems' parts.		- Determination of safety rules and safety of the vehicle and equipment  - Classification of engine and explanation of its parts and their operation			<b>A1, A2, A3, A4, A5, A6, A7, A8, A9</b>  <b>B2, C2, D1</b>																													

3) Check engines and their operating systems.	- Check the correct procedure: parts operation, leakage, belt tension, hoses, part conditions	<b>D2, D3, D4, D5, D6, D7, D9</b>
4) Perform maintenance on engines and their operating systems.	- Adjustment of clearance and replacement of parts according to specifications	<b>C5</b>
5) Repair engines and their operating systems.	- Disassembly and measurement of parts and the determination of required repair, and reassembly of parts after repairing correctly	<b>B8, H1, H3, H4</b>
6) Test performance of engines and their operating systems.	- Correct use of tests and diagnostic equipment	<b>B2, B3, B7</b>
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Explain operation principles of engines and their operating systems.	- Explanation of the engine fundamental theory of operation	<b>B5, D2</b>
2) Identify engine parts and their method of operation.	- Explanation of operation of engine parts	<b>D5, D6</b>
3) Identify lubrication system parts and method of operation.	- Explanation of the operation of lubrication system parts	<b>D2, D3, D9</b>
4) Identify cooling system parts and method of operation.	- Explanation of the operation of cooling system, parts	<b>D4</b>
5) Identify emission control system parts.	- Explanation of the operation of emission control system parts	<b>D9</b>
6) Recognize periodic maintenance for engines and their operating systems and specify the required equipment to perform it.	- Identification of the functions and ways of maintenance and types of the equipment used	<b>C5</b>

**Safety Requirements:**

- Compliance with safety instructions given in service and maintenance manuals
- Follow the required precautions when dealing with automotive engines and related systems.

Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Principles of engine operations and their operating systems</li> </ul>	<b>D4, D7</b>	<ul style="list-style-type: none"> <li>- Checking and adjustment of parts</li> </ul>
<ul style="list-style-type: none"> <li>- Servicing lubrication systems</li> <li>- Servicing cooling system</li> </ul>	<b>B6, B8</b>	<ul style="list-style-type: none"> <li>- Replacement and maintenance of parts</li> </ul>
<ul style="list-style-type: none"> <li>- Servicing emission control systems</li> <li>- Engine and operating system faults and problems</li> <li>- Methods of inspection of engines and operating systems and inspection equipment</li> <li>- Engines and their operating system maintenance program</li> </ul>	<b>H3, H4</b>	<ul style="list-style-type: none"> <li>- Repair parts</li> </ul>



Detailed Theoretical Course		
Hours	Content	Evaluation Tools
6	<b>Fundamentals of internal combustion engines:</b> <ul style="list-style-type: none"> <li>- Engine classifications according to: <ul style="list-style-type: none"> <li>- Cylinder arrangement</li> <li>- Cooling system</li> <li>- Valve location</li> <li>- Number of valves</li> <li>- Combustion chamber design</li> <li>- Cam shaft location</li> </ul> </li> <li>- Engine operation: <ul style="list-style-type: none"> <li>- Ignition method (gasoline/diesel)</li> <li>- Engine strokes (four stroke/two stroke engines)</li> </ul> </li> </ul>	Oral questions Written questions Self test
6	<b>Mechanical parts of internal combustion engines:</b> <ul style="list-style-type: none"> <li>- Functions, types, and operations of: <ul style="list-style-type: none"> <li>- Cylinder block (cylinders – water jacket – oil passages – pistons – connecting rods – crankshaft)</li> <li>- Cylinder head (combustion chambers – valves – cam shaft – cam shaft cover)</li> <li>- Engine front end (water pump – timing system – timing system cover – crankshaft pulley)</li> <li>- Crank case (oil pickup screen – oil pump)</li> <li>- Oil seals and gaskets</li> </ul> </li> </ul>	
6	<b>Engine performance:</b> <ul style="list-style-type: none"> <li>- Engine dimensions and performance measurement <ul style="list-style-type: none"> <li>- Top dead center/bottom dead center</li> <li>- Stroke</li> <li>- Piston dimensions</li> <li>- Engine capacity</li> </ul> </li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Compression ratio</li> <li>- Engine pressures</li> <li>- Engine torque</li> <li>- Engine power</li> <li>- Fuel consumption</li> <li>- Engine efficiency</li> <li>- Performance curves</li> <li>- Methods of improving engine performance               <ul style="list-style-type: none"> <li>- Increasing number of valves</li> <li>- Supercharging</li> <li>- Variable valve timing</li> <li>- Variable displacement</li> </ul> </li> </ul>	Oral questions Written questions Self test
15	<b>Engine systems:</b> <ul style="list-style-type: none"> <li>- Lubrication systems:               <ul style="list-style-type: none"> <li>- Function and types of lubrication system</li> <li>- Lubrication circuit (parts, function, method of operation, and types)</li> <li>- Engine oil characteristics and specifications</li> <li>- System faults and methods of their detection, and equipment used</li> </ul> </li> <li>- Cooling system:               <ul style="list-style-type: none"> <li>- System function</li> <li>- System types</li> <li>- Cooling circuit (parts, function, method of operation, and types)</li> <li>- Coolant characteristics</li> <li>- System faults and methods of their detection, and equipment used</li> </ul> </li> <li>- Engine intake and induction system:               <ul style="list-style-type: none"> <li>- Intake system function</li> <li>- Intake system parts</li> </ul> </li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Operation of Intake system</li> <li>- Advantages of engine induction</li> <li>- Methods of engine induction (different systems)</li> <li>- Parts and operation of induction systems</li> <li>- Exhaust systems:               <ul style="list-style-type: none"> <li>- Function of exhaust systems</li> <li>- Exhaust system parts</li> <li>- Operation of exhaust systems</li> </ul> </li> <li>- Valves:               <ul style="list-style-type: none"> <li>- Types of valves (parts – construction)</li> <li>- Methods of valve control and adjustment</li> <li>- Valve timing</li> </ul> </li> <li>- Exhaust emission control systems:               <ul style="list-style-type: none"> <li>- Different types, functions, and operation</li> <li>- Crank case ventilation</li> <li>- Exhaust gas recirculation (EGR)</li> <li>- Control of intake charge temperature</li> <li>- Catalytic converters</li> <li>- Fuel evaporation control system</li> <li>- Modern and recent technologies</li> </ul> </li> </ul>	<p>Oral questions Written questions Self test</p>
6	<b>Alternative engines:</b> <ul style="list-style-type: none"> <li>- Rotary engine</li> <li>- Natural gas engine</li> <li>- Electric motor (battery / fuel cells)</li> <li>- Hybrid vehicle engines</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Engine workshops</b> <ul style="list-style-type: none"> <li>- Identification of safety precautions in engine workshops</li> <li>- Identification of tools and equipment in engine workshop</li> <li>- Identification of methods of using manuals and catalogues</li> </ul>	Direct observation (practical performance) Oral questions
12	<b>Automotive engine parts:</b>  Through one training engine or more of the following are to be accomplished: <ul style="list-style-type: none"> <li>- Identification of engine classifications               <ul style="list-style-type: none"> <li>- Cam location, number of cylinders, firing order, number of valves, charge intake, engine ignition system, cam shaft location, timing gears, crank shaft</li> </ul> </li> <li>- Identification of engine parts               <ul style="list-style-type: none"> <li>- Cylinder block, cylinder head, engine front end, oil pan, valve and timing gears covers, types of engine oil seals, piston assembly, timing gear assembly, crankshaft assembly, valve operation assembly</li> </ul> </li> <li>- Measurements of engine dimensions               <ul style="list-style-type: none"> <li>- Cylinder bore</li> <li>- Piston dimension</li> <li>- Length of stroke</li> <li>- Determination of engine displacement</li> <li>- Measurement of clearance volume and determination of compression ratio</li> </ul> </li> </ul>	
6	<b>Engine performance testing:</b> <ul style="list-style-type: none"> <li>- Using engine dynamometer to measure:               <ul style="list-style-type: none"> <li>- Engine power</li> <li>- Engine torque</li> <li>- Fuel consumption</li> </ul> </li> <li>- Plotting engine performance curves</li> </ul>	
6	<b>Engine lubrication systems:</b> <ul style="list-style-type: none"> <li>- lubrication circuit in the engine               <ul style="list-style-type: none"> <li>- identification of lubrication circuit parts</li> <li>- follow up circuit connection</li> </ul> </li> <li>- Engine oil               <ul style="list-style-type: none"> <li>- Checking engine oil level and compensating the losses</li> </ul> </li> </ul>	Direct observation (practical performance) Oral questions

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Change engine oil and filter</li> <li>- Oil pump               <ul style="list-style-type: none"> <li>- Removing the oil pump</li> <li>- Disassembly of the oil pump</li> <li>- Checking oil pump parts (gears – clearance – leveling of the surface) and determine its condition</li> </ul> </li> <li>- Oil pressure sensor               <ul style="list-style-type: none"> <li>- Measurement of oil pressure</li> </ul> </li> <li>- Checking sensor circuit</li> <li>- Oil circuit valves               <ul style="list-style-type: none"> <li>- Identification of valve types</li> <li>- Valve removal and identification of its operation parts</li> </ul> </li> <li>- Oil pan (sump)               <ul style="list-style-type: none"> <li>- Removal of oil pan and checking it</li> <li>- Gasket installation</li> <li>- Reinstalling of oil pan</li> </ul> </li> </ul>	
6	<p><b>Engine cooling systems:</b></p> <ul style="list-style-type: none"> <li>- Engine cooling circuit               <ul style="list-style-type: none"> <li>- Identification of engine cooling circuit</li> <li>- Follow up circuit connections</li> </ul> </li> <li>- The coolant               <ul style="list-style-type: none"> <li>- Checking coolant level and topping it</li> <li>- Checking leakage (eye checking – pressure test)</li> <li>- Discharge of coolant and refilling of radiator</li> <li>- Measure (liquid contamination – electrical connection to liquid – liquid density and concentration)</li> </ul> </li> <li>- The radiator               <ul style="list-style-type: none"> <li>- Determination of radiator type</li> <li>- Checking (leakage – radiator fins – flow)</li> <li>- Radiator removal out of the vehicle</li> <li>- Clearing radiator pipes</li> <li>- Checking radiator performance</li> </ul> </li> <li>- Radiator cap               <ul style="list-style-type: none"> <li>- Identification of cap specifications</li> <li>- Checking performance of cap</li> <li>- Checking parts of radiator cap (seal, spring, pressure</li> </ul> </li> </ul>	<p>Direct observation (practical performance) Oral questions</p>

Detailed Practical Course		
Hours	Content	Evaluation Tools
	valve, vacuum valve) - Overflow tank - Checking tank - Checking tank operation - Replacement of overflow tank - Thermostat - Checking and testing thermostat - Replacement of thermostat - Water pump - Checking pump performance - Removal of pump from its place - Disassembly of pump and checking its parts - Pump replacement - Cooling fan and shroud - Checking operation of cooling fan (mechanical – electrical) and its parts - Checking the shroud - Temperature sensor - Checking sensor circuit - Sensor inspection - Engine body core - Checking core - Core replacement	Direct observation (practical performance) Oral questions
6	<b>Exhaust emission control systems:</b> - Positive crank case ventilation system - Identification of system and parts - Checking system operation - Checking connections and parts - System maintenance - Replacement of the system or one of its components - Fuel evaporation system - Identification of system and parts - Checking system operation - Checking connections and parts - System maintenance - Replacement of the system or one of its components - Air intake heating system - Identification of system and parts - Checking system operation - Checking connections and parts - System maintenance	

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Replacement of the system or one of its components</li> <li>- Exhaust gas recirculation system               <ul style="list-style-type: none"> <li>- Identification of system and parts</li> <li>- Checking system operation</li> <li>- Checking connections and parts</li> <li>- System maintenance</li> </ul> </li> <li>- Replacement of the system or one of its components</li> <li>- Air injection system               <ul style="list-style-type: none"> <li>- Identification of system and parts</li> <li>- Checking system operation</li> <li>- Checking connections and parts</li> <li>- System maintenance</li> </ul> </li> <li>- Replacement of the system or one of its components</li> <li>- Catalytic converters               <ul style="list-style-type: none"> <li>- Identification of system and parts</li> <li>- Checking system operation</li> <li>- Checking connections and parts</li> <li>- System maintenance</li> </ul> </li> <li>- Replacement of the system or one of its components</li> </ul>	Direct observation (practical performance) Oral questions
8	<b>Intake and exhaust manifolds and superchargers:</b> <ul style="list-style-type: none"> <li>- Air filter               <ul style="list-style-type: none"> <li>- Identification of different types</li> <li>- Filter cleaning and replacement if required</li> </ul> </li> <li>- Intake and exhaust manifolds               <ul style="list-style-type: none"> <li>- Identification of different types</li> <li>- Replacement of system seals and gaskets</li> </ul> </li> <li>- Valves               <ul style="list-style-type: none"> <li>- Identification of different types and construction</li> <li>- Identification of methods of controlling valves</li> <li>- Valve adjustment</li> </ul> </li> <li>- Supercharging               <ul style="list-style-type: none"> <li>- Identification of different types</li> <li>- Checking charger operation</li> <li>- Checking operation of circuit parts</li> <li>- Charger maintenance and replacement</li> </ul> </li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Exhaust gas analysis:</b> <ul style="list-style-type: none"><li>- identification of different types of exhaust analyzers and method of operation</li><li>- inspection of vehicle exhaust and analysis of results</li></ul>	Direct observation (practical performance) Oral questions



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- 2- Don Knowles, Jack Erjavec, "Automotive Engine Performance", Delmar Publishers, 1998, ISBN 0-8273-8519-6
- 3- William H. Crouse and Donald L. Anglin, "Automotive Mechanics" The McGrawHill Book Company, ISBN 0-02-800943-6
- 4- Jay Webster, Clifton E. Owen, "Basic Automotive Service & Repair", Delmar Publishers, 2000, ISBN 0-8273-8544-7
- 5- Don Knowles, "Automotive Technician Certification- Test Preparation Manual", Delmar Publishers, 2001, ISBN 0-7668-1948-5
- 6- Martin, W. Stokel and Martin "Auto Mechanics Fundamentals", The GoodheartWillcox company, INC, ISBN 1-56637-138-4, 1996
- 7- Stoekel, Stockel, and Johanson, "Auto Service & Repair", The GoodheartWillcox company, INC, 1996, ISBN 1-56637-144-9
- 8- Martin W. Stokel, Martin T. Stokel Cluis Johanson "Auto Fundamentals" The GoodheartWillcox company, INC, 1996, ISBN 1-56637-1384,
- 9- William, K. Toboldt, Larry Johnson, and W. Scott Gavthier, "Automotive Encyclopedia" Fundamental, Principles, Operation, Construction, Service, and Repair- The Goodheart-Willcox company, 1995, INC, ISBN 1-56637-150-3
- 10- Jack Enjavec "Automotive Technology", Delmar Publishers, 2000, ISBN 0-7668-0673-1
- 11- Jack Enjavec, Robert Scharff, "Automotive Technology", Delmar Publishers, 1992, ISBN 0-8273-6724-4
- 12- Robert Bosch GmbH "Automotive Handbook" Published by VDI-Verlag, 1996, ISBN 3-1-419115-X
- 13- Duffy, James E., "Auto Engines" The GoodheartWillcox company, INC, ISBN 0-87006A77-3
- 14- Martin W. Stockel, Martin T. Stockel, and Chris Johanson, "Auto Diagnosis, Service, and Repair", The Goodheart-Willcox Company, Inc., Tinley Park, Illinois, 2003, ISBN 1-56637-910-5
- 15- Crouse – Anglin, "Automotive Mechanics" - 10<sup>th</sup> Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6
- 16- William H. Crouse and Donald L. Anglin, "The Auto Book" – 3<sup>rd</sup> Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7
- 17- William H. Crouse and Donald L. Anglin, "Automotive Technician's Handbook", The McGraw-Hill Book Company, ISBN 0-07074751-5

Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Brake systems	Code	251 MEV					
Prerequisite	163 MEV							
<b>Course description:</b> This course provides the trainees with the basics of brake systems showing different types of system components, with the explanation of the characteristics, parts, and method of operation of brake systems. The trainees will be trained on how to deal with different brake systems regarding inspection, adjustment, replacement, maintenance and repair of parts. The trainees will be given the skills to follow up faults and repair it.								
		Trimester		1	2	3	4	5
		Credit hours					4	
		Contact hours	L				2	
			W				4	
		T				-		
<b>General course objective:</b> This course aims at giving the trainees the basic skills required to deal with brake systems, from the viewpoint of fault inspection, replacement, and repair of system parts, in addition to training on adjustment and maintenance operations and how to use testing and diagnostic tools and equipment.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b>First: Procedural Objectives:</b> <b>The trainees should be able to:</b>  1) Follow safety instructions in brake workshops.  2) Identify brake system parts.  3) Check brake systems.		  - Identification of sources of hazards in the workshop, personal safety precautions and the safety of the vehicle and equipment  - Identification of different types and parts and method of operation  - Checking condition and operation of parts – checking leakage			  <b>A1, A2, A3, A4, A5, A6, A7, A8</b>  <b>B2, B4</b>  <b>F1, F3, F6, F8, F9, F10,</b>			

<p>4) Perform maintenance operation on brake systems.</p> <p>5) Repair brake systems.</p> <p>6) Test brake system performance.</p>	<ul style="list-style-type: none"> <li>- Replacement of parts – clearance adjustment – bleeding air</li> <li>- Dismantling and measurement of parts, and determination of type of the required repair, and reinstalling parts after repair</li> <li>- Road testing the vehicle and use test and diagnostic equipment</li> </ul>	<p><b>F4, F5, J1, J3, J5, J6, J8, J10..J14 J2, J4, J7, J9</b></p> <p><b>B3, J15</b></p>
<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <p>1) Identify the basics of brake operations.</p> <p>2) Identify service brake parts and method of operation.</p> <p>3) Identify the parking brake parts and method of operation.</p> <p>4) Identify the anti-lock brake system parts and method of operation.</p> <p>5) Identify the periodic maintenance of brakes and the required equipment to perform it.</p>	<ul style="list-style-type: none"> <li>- Explanation of brake fundamentals and theory of operation</li> <li>- Explanation of the operation of service brake parts</li> <li>- Explanation of the operation of parking brake parts</li> <li>- Explanation of the operations of anti-lock brake system</li> <li>- Definition of the function and procedure of maintenance and the types of equipment used</li> </ul>	<p><b>F4, F6, F7, F9</b></p> <p><b>F1, J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11</b></p> <p><b>J8, J14</b></p> <p><b>J1, J14</b></p>
<p><b>Safety Requirements:</b>  Compliance with safety instructions given in service and maintenance manuals, and following of safety precautions when dealing with brake systems.</p>		

Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Fundamentals of brake systems</li> <li>- Maintenance and repair of service brakes</li> </ul>	<b>F1, J12</b>	<ul style="list-style-type: none"> <li>- Checking and adjusting brake system parts</li> </ul>
<ul style="list-style-type: none"> <li>- Maintenance and repair of parking brakes</li> <li>- Brake system faults and problems</li> </ul>	<b>F4..F10, J1, J3, J5, J6, J8, J10, J11, J13, J14</b>	<ul style="list-style-type: none"> <li>- Replacement and maintenance of brake system parts</li> </ul>
<ul style="list-style-type: none"> <li>- Methods and equipment of testing brake system</li> </ul>	<b>J2, J4, J7, J9</b>	<ul style="list-style-type: none"> <li>- Repair brake system parts</li> </ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Braking fundamentals:</b> <ul style="list-style-type: none"> <li>- Importance of brakes</li> <li>- Theory of brake operations</li> <li>- Functions of vehicle brakes</li> <li>- Classifications of vehicle brakes               <ul style="list-style-type: none"> <li>- Service brakes</li> <li>- Parking brakes</li> <li>- Components and functions of service brake circuit</li> <li>- Components and functions of parking brake circuit</li> </ul> </li> </ul>	Written questions Oral questions Self test
4	<b>Service brakes:</b> <ul style="list-style-type: none"> <li>- Brake pedal               <ul style="list-style-type: none"> <li>- Function of pedal, its method of operation, and mechanical advantage in pedal</li> </ul> </li> <li>- Hydraulic brake system               <ul style="list-style-type: none"> <li>- Hydraulic principles</li> <li>- Brake hydraulic circuit (function – components – types – method of operation – hydraulic advantages)</li> <li>- Master cylinder (function – types - construction – parts – function and method of operation of parts)</li> <li>- Wheel cylinder (function – types - construction – parts – function and method of operation of parts)</li> <li>- Brake pipes and hoses (function – types – construction)</li> <li>- Brake fluid ( types – characteristics – specifications)</li> <li>- Control valves (functions – types)</li> <li>- Hydraulic circuit faults and problem</li> </ul> </li> </ul>	
4	<b>Wheel brakes:</b> <ul style="list-style-type: none"> <li>- Disc brakes (function – types - construction – parts – function and method of operation of parts)</li> <li>- Drum brakes (function – types - construction – parts – function and method of operation of parts)</li> <li>- Definition of the parameters affect friction force, coefficient of friction</li> <li>- Friction lining (types – characteristics – specifications – methods of indicating lining wear)</li> <li>- Wheel bearing and seals (function – types – construction)</li> <li>- Wheel brake faults and problems (types – source – methods of detecting and repair)</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Brake booster:</b> <ul style="list-style-type: none"> <li>- Function of brake booster</li> <li>- Types of boosters (vacuum – hydraulic), method of operation, constructions, parts, and function of parts</li> <li>- Booster faults and problems (types – sources - methods of detecting and repair)</li> </ul>	Written questions Oral questions Self test
4	<b>Brake performance and problems:</b> <ul style="list-style-type: none"> <li>- Braking performance <ul style="list-style-type: none"> <li>- Braking force</li> <li>- Deceleration</li> <li>- Stopping distance</li> <li>- Brake fade</li> <li>- Braking efficiency</li> </ul> </li> <li>- Brake performance problems <ul style="list-style-type: none"> <li>- Types and sources of brake performance problems</li> <li>- Wheel lock problem (causes – danger of wheel lock – method of handling the problem)</li> <li>- Anti-lock brake system (ABS) (function – components – types – parts and function)</li> <li>- Their function, mode of operation, related parts</li> <li>- Master and wheel cylinder faults</li> <li>- Brake pipes</li> <li>- Their function, types and faults</li> <li>- Master and wheel cylinder and brake pipes maintenance</li> </ul> </li> </ul>	
2	<b>Parking brakes:</b> <ul style="list-style-type: none"> <li>- Parking brake circuit <ul style="list-style-type: none"> <li>- Function of parking brakes</li> <li>- Types of parking brakes</li> <li>- Components and parts of parking brakes</li> <li>- Function and method of operation of components and parts</li> </ul> </li> </ul>	

6	<b>Using brake systems in vehicle control:</b> <ul style="list-style-type: none"><li>- Tyre anti-skid system</li><li>- Electronic system for vehicle stability</li><li>- Brake force distribution system on wheels</li><li>- System of transferring kinetic energy to electrical energy to charge the battery</li><li>- System of increasing brake force</li><li>- Vehicle speed control system (speed holding)</li><li>- Automatic transmission control system</li></ul>	Written questions Oral questions Self test
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Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Brake workshops:</b> <ul style="list-style-type: none"> <li>- Identification of safety precautions in brake workshops</li> <li>- Identification of tools and equipment in workshops</li> <li>- Identification of the method of using catalogues</li> </ul>	Direct observation (practical performance) Oral questions
10	<b>Identification of brake system components:</b> <ul style="list-style-type: none"> <li>- Brake circuit               <ul style="list-style-type: none"> <li>- Identification of brake circuit in the vehicle (type of circuit – parts – connections – methods of fitting parts)</li> </ul> </li> <li>- Brake pedal               <ul style="list-style-type: none"> <li>- Identification of pedal position and its connections with the vehicle</li> <li>- Fault diagnosis of the brakes and the existence of air in brake circuit (feeling the pedal condition – pedal travel)</li> <li>- Checking operation of rear brake light</li> </ul> </li> <li>- Brake fluid               <ul style="list-style-type: none"> <li>- Identification of different types of brake fluids</li> <li>- Fault diagnosis of the brake (observation of fluid level – observation of fluid sloshing through compensating port when using brakes)</li> <li>- Figuring out the existence of air in the circuit by observing brake fluid when releasing brake</li> </ul> </li> <li>- Brake booster               <ul style="list-style-type: none"> <li>- Identification of booster types</li> <li>- Checking booster operation</li> <li>- Checking non-return valve operation</li> </ul> </li> <li>- Parking brakes               <ul style="list-style-type: none"> <li>- Identification of parking brakes</li> <li>- Checking operation of parking brakes</li> </ul> </li> <li>- Valves               <ul style="list-style-type: none"> <li>- Identification of types of valves</li> <li>- Methods of valve connection to the circuit</li> </ul> </li> <li>- Anti-lock brake system (ABS)               <ul style="list-style-type: none"> <li>- Identification of system circuit and components</li> </ul> </li> </ul>	



Detailed Practical Course		
Hours	Content	Evaluation Tools
8	<b>Brake system inspections:</b> <ul style="list-style-type: none"> <li>- Master cylinder <ul style="list-style-type: none"> <li>- Checking of ventilation port in cover</li> <li>- Checking connections and leakage</li> </ul> </li> <li>- Disc brakes <ul style="list-style-type: none"> <li>- Checking friction lining thickness</li> <li>- Checking disc</li> <li>- Checking caliper (leakage – dust boot condition)</li> </ul> </li> <li>- Drum brakes <ul style="list-style-type: none"> <li>- Checking rear of backing plate (existence of oil – lubricants)</li> </ul> </li> <li>- Parking brakes <ul style="list-style-type: none"> <li>- Checking operation of parking brakes</li> <li>- Checking connections</li> </ul> </li> <li>- Brake circuit hoses and pipes <ul style="list-style-type: none"> <li>- Checking leakage</li> <li>- Checking condition of pipes and hoses</li> <li>- Checking fittings</li> </ul> </li> </ul>	Direct observation (practical performance) Oral questions
14	<b>Maintenance of brake circuit parts:</b> <ul style="list-style-type: none"> <li>- Brake fluid <ul style="list-style-type: none"> <li>- Change the brake fluid</li> <li>- Bleeding air from the circuit (using different methods)</li> </ul> </li> <li>- Booster <ul style="list-style-type: none"> <li>- Dismantling the booster</li> <li>- Clearance adjustment of booster rod</li> <li>- Installing the booster</li> </ul> </li> <li>- Brake pedal <ul style="list-style-type: none"> <li>- Adjustment of pedal free travel</li> <li>- Clearance adjustment of rear warning light sensor</li> </ul> </li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Master cylinder               <ul style="list-style-type: none"> <li>- Removal the cylinder off the vehicle</li> <li>- Replacement of the cylinder</li> <li>- Adjustment of pedal free travel</li> </ul> </li> <li>- Wheel brakes               <ul style="list-style-type: none"> <li>- Checking condition of linings and replacement</li> <li>- Checking and replacement of wheel cylinders</li> <li>- Installing hubs</li> <li>- Brake adjustment and self adjustment</li> <li>- Checking condition of rubber seal of caliper cylinder and replacing it</li> <li>- Replacement and installation of dust boot</li> </ul> </li> </ul>	Direct observation (practical performance) Oral questions
8	<b>Repair of brake circuit parts:</b> <ul style="list-style-type: none"> <li>- Master cylinder               <ul style="list-style-type: none"> <li>- Disassembly of the master cylinder</li> <li>- Installing brake pads</li> <li>- Air bleeding on working table</li> <li>- Installing master cylinder</li> <li>- Adjustment of pedal free travel</li> <li>- Adjustment of rear warning lamp</li> </ul> </li> <li>- Disc brakes               <ul style="list-style-type: none"> <li>- Dismantling the disc</li> <li>- Perform measurement</li> <li>- Determine the need of turning</li> <li>- Installing the disc</li> </ul> </li> <li>- Drum brakes               <ul style="list-style-type: none"> <li>- Dismantling the hubs</li> <li>- Perform measurement</li> <li>- Determine the need of turning</li> </ul> </li> <li>- Wheel bearings               <ul style="list-style-type: none"> <li>- Replacement</li> <li>- Adjustment and tighten</li> </ul> </li> </ul>	
10	<b>Testing brake system performance:</b> <ul style="list-style-type: none"> <li>- Fault diagnosis of brake system operation               <ul style="list-style-type: none"> <li>- Testing the brakes while driving</li> <li>- Checking using tools and equipment</li> <li>- Detecting brake faults (no brakes – weak brakes – vehicle deviation – noise during brake – brake warning light on – wheel heating)</li> </ul> </li> <li>- Checking anti-lock brake system (ABS)</li> </ul>	Direct observation (practical performance) Oral questions

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"><li>- Checking sensors and adjustment of clearance</li><li>- Checking the system operation using test equipment</li><li>- Replacement of sensors</li></ul>	

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- 5- A. K. Baker, "Vehicle Braking", Pentech Press – London : Plymouth, 1986, ISBN 0-7273-2202-8
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	<p><b>Goodheart-Willcox Company, Inc., Tinley Park, Illinois, 2003, ISBN 1-56637-910-5</b></p> <p><b>18- Crouse – Anglin, “Automotive Mechanics” - 10<sup>th</sup> Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6</b></p> <p><b>19- William H. Crouse and Donald L. Anglin, “The Auto Book” – 3<sup>rd</sup> Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7</b></p> <p><b>20- William H. Crouse and Donald L. Anglin, “Automotive Technician’s Handbook”, The McGraw-Hill Book Company, ISBN 0-07074751-5</b></p>
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Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Technical Drawing	Code	174 MEV					
Prerequisite	164 MEV							
<b>Course description:</b> In this course the identifications of types of technical drawings including the use of graphical charts to indicate the relationship of different parameters in vehicle areas, and the use of schematic drawings to indicate the components of different vehicle mechanical and electrical systems and their symbols and stages of operations will be covered. The course also includes the use of engineering drawing to draw vehicle components and elements, and the use of assembly drawings and sections of vehicle system parts.								
		Trimester	1	2	3	4	5	
		Credit hours			2			
		Contact hours	L			-		
			W			4		
	T			-				
<b>General course objectives:</b> This course aims at training the automotive technician on conceiving and following up the illustrative diagrams of circuits and parts included in technical maintenance books. This helps the trainees to understand the relationships of different parameters affecting parts operation and performance, giving him the skills to undertake technical drawings as a means of illustration and conveyance of ideas.								
Detailed Objectives		Required Performance Specifications		Related Tasks				
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Draw schematic diagrams (vehicle system circuits – steps and stages of operation of vehicle units).  2) Draw engineering drawings for vehicle system elements.  3) Apply engineering drawings to draw parts and units of vehicle systems.		- Drawing of circuits (electrical – electronic – mechanical)  - Drawing of fittings and power transmission elements  - Assembly drawing for sectioned parts and units of vehicle systems and locating dimensions on them		<b>B5, B8, C5, D4, D7, D8, D10, G1, G10, G16, H1..H5, K4, L3, E9..E11, F4, G13, G14, I1..I4, I8, I9, I!2..I14, I16, J11, K10, K15, K16 E8, F5, G3, H1, H2, I1, J4</b>				

<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <ol style="list-style-type: none"> <li>1) Understand graphical charts.</li> <li>2) Understand diagrams in books and catalogue.</li> <li>3) Express technical ideas using drawings.</li> </ol>	<ul style="list-style-type: none"> <li>- Explanation of parts design and construction</li> <li>- Writing of technical reports</li> <li>- Writing of technical reports</li> </ul>	<p><b>A9</b></p> <p><b>C5</b></p> <p><b>H7, I19, K20</b></p>
<p><b>Safety Requirements:</b>  Clean place with good ventilation and lighting.</p>		
Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Graphical charts</li> <li>- Schematic diagrams</li> <li>- Assembly drawing</li> <li>- Exploded drawing (individual for internal parts of components)</li> <li>- Application of engineering drawing</li> </ul>	<p><b>B9, C5</b></p>	<ul style="list-style-type: none"> <li>- Understanding technical drawings and ability to read maintenance and repair books</li> </ul>

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Technical drawings:</b> <ul style="list-style-type: none"> <li>- Identification of the types of technical drawings</li> </ul>	Direct observation Written questions
8	<b>Graphical drawings:</b> <ul style="list-style-type: none"> <li>- The purpose of graphical drawings</li> <li>- Types of graphical drawings</li> <li>- Method of representation of graphical drawings</li> <li>- Applications on graphical drawings</li> </ul>	
15	<b>Schematic diagrams:</b> <ul style="list-style-type: none"> <li>- The purpose of schematic diagram</li> <li>- Types of schematic diagram</li> <li>- Symbols used in schematic diagram</li> <li>- Applications on schematic diagram</li> </ul>	
25	<b>Applications of engineering drawing</b> <ul style="list-style-type: none"> <li>- Fasteners and their attachments (bolts – rivets – welding)</li> <li>- Power connection elements and attachments (shafts – keys – splines – sliding bearings – roller bearings – seals)</li> <li>- Power transmission elements and attachments (sprockets – gears – cams – springs)</li> <li>- Assembly drawing and sections of some vehicle system</li> </ul>	



**References:**

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- 2- Ahed Ali Alkhateeb, “Engineering Working Drawing”, Dar Al-Kheraiji for Publication & Distribution , 2002, ISBN 9960-879-09-7**

Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Power Transmission System	Code	173 MEV					
Prerequisite	163 MEV							
<b>Course description:</b> The course presents the study of the principles of operation and details of different parts of manual power train systems in light vehicles with rear, front, and four-wheel drives. The practical part covers training on methods of testing, inspection, disassembly, assembly, and repairing of faults for parts of different types of power transmission systems.								
		Trimester		1	2	3	4	5
		Credit hours				4		
		Contact hours	L			2		
			W			4		
		T			-			
<b>General course objective:</b> The course aims at giving the trainees basic skills in detecting faults and carrying out required repairs for different types of manual power transmission systems, and the methods of inspecting parts using specialized tools and equipment.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Follow safety procedures in power transmission workshops, and the correct methods of using tools, equipment, testing apparatus, and securing vehicle lifts.  2) Determine different transmission types and explain their components.  3) Explain types, parts and method of operation of the clutches used in vehicles.  4) Detect faults and repair the clutch and reinstall it.  5) Explain different types of manual gearboxes used in rear and front drive, their parts and method of operation, and trace power flow through gears in both types for each mesh.		  - Following up safety rules and using tools correctly   - Determination of transmission types   - Explanation of clutch types, parts, and operation   - Clutch functions correctly according to recommendations   - Explanation of gear box types, parts, and operations			  <			

6) Detect faults and repair gear boxes and reinstall it.	- Gear box functions with the required efficiency	<b>E2, E3, E5, E7, E9, I10, I13, I18, I19</b>
7) Explain parts, types, and operation of axles, drive shaft (propeller), and final drive of different types of vehicle power transmission systems.	- Explanation of types, parts, and operation of axles, propeller shafts, and final drives of rear, front, and four wheel drive power transmission systems	<b>E2, E5, E7..E12, I12..I18</b>
8) Detect faults, repair, and adjust propeller shafts.	- Repair and adjustment of propeller shaft with correct steps according to specifications	<b>E5, E7, E12, I17</b>
9) Check, repair, and calibrate differentials.	- Differential functions correctly	<b>E2, E5, E7..E9, I9, I12, I13, I16</b>
10) Check and replace axles.	- Axles function correctly according to recommendations	<b>E5, E7, E10, E11, I14, I15, I18</b>
11) Prepare executed job report.	- Accomplish maintenance report of the achieved work in accordance with the common practice followed in vehicle agencies	<b>I19</b>
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Arrange required tools and prepare work places.	- Preparation of work place and arrangement of required tools	<b>A2, A3</b>
2) Apply what he has learned in the specialized mathematics and physics courses to define friction, clutch torque, and gear ratios.	- Calculation of clutch torque and gear ratios	<b>E1, E11</b>
3) Compare between different types of power transmission systems.	- Correct differentiation between power transmission system types	<b>E1</b>

4) Read and analyze achieved job report.	- Correct analysis of achieved job report	<b>I19</b>
<b>Safety Requirements:</b> - Compliance with safety instructions given in user manual of testing equipment - Compliance of safety instructions in transmission workshops		
Subjects (Theoretical and Practical)	Related Tasks	
- Types and components of vehicle power transmission systems	<b>E1</b>	- Determine type of transmission
- Clutch and types	<b>E5, I1</b>	- Determine type and source of noise - Inspect the flywheel and replace clutch
- Gear boxes and types	<b>E2, E5, E9, I8, I10</b>	- Check transmission fluid level - Determine type and source of noise - Check seals, oil rings, and gaskets - Replace gears and bearings of transmission - Adjust the gear shift lever
- Drive shafts and joints and their types	<b>E12, I17</b>	- Check universal joints - Replace universal joints of propeller shaft
- Final drive and axles and their types	<b>E2, E8, E9, E10, E11</b>	- Check transmission fluid level - Check differential gears - Check seals, oil rings, and gaskets - Check drive axles - Check propeller shaft support bearings
- Four wheel drive power transmission systems	<b>E1</b>	- Determine type of transmission

<ul style="list-style-type: none"> <li>- Fault diagnosis, repair or replacement of power transmission parts and preparation of achieved job report</li> </ul>	<p><b>E3, E5, I1, I8, I9, I12..I18</b></p>	<ul style="list-style-type: none"> <li>- Observe transmission fluid quality by color and smell</li> <li>- Determine type and source of noise</li> <li>- Inspect the flywheel and replace clutch</li> <li>- Replace gears and bearings of transmission</li> <li>- Replace transmission oil seals and gaskets</li> <li>- Replace differential gears</li> <li>- Repair oil leakage source</li> <li>- Replace drive (wheel) axles</li> <li>- Replace drive shafts bearings</li> <li>- Adjust differential gears</li> <li>- Replace universal joints of the propeller shaft</li> <li>- Prepare achieved job report</li> </ul>
<ul style="list-style-type: none"> <li>- Checking components of power transmission systems using special tools and equipment</li> </ul>	<p><b>E7</b></p>	<ul style="list-style-type: none"> <li>- Use testing equipment</li> </ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Vehicle power transmission systems:</b> <ul style="list-style-type: none"> <li>- Function of transmission system</li> <li>- Types and components of power transmission from engine to drive wheels               <ul style="list-style-type: none"> <li>- Rear wheel drive</li> <li>- Front drive</li> <li>- Four wheel drive</li> </ul> </li> </ul>	Written questions Oral questions Self test
4	<b>The clutch:</b> <ul style="list-style-type: none"> <li>- Function of the clutch</li> <li>- Vehicle clutch types</li> <li>- Friction clutch and types</li> <li>- Parts and operation of clutch (flywheel – clutch shaft – clutch discs and types – pressure plate assembly – coil and diaphragm springs – release bearing)</li> <li>- Calculation of transmitted torque from the clutch</li> <li>- Declutching mechanism and types (mechanical – hydraulic)</li> </ul>	
6	<b>Gear boxes:</b> <ul style="list-style-type: none"> <li>- Importance and function of gear box and method of increasing engine torques</li> <li>- Types of gears used (spur – helical – etc)</li> <li>- Methods of gear shifting (sliding – constant mesh)</li> <li>- Calculation of gear ratios in gear box</li> <li>- Types of conventional (manual) gear boxes</li> <li>- Conventional gear box in rear wheel drive system:               <ul style="list-style-type: none"> <li>- Gear box parts (shafts – bearings – gears – oil seals)</li> <li>- Synchronizer mechanism and method of gear shifting (synchronizer units – shift fork – shift lever)</li> <li>- Operation of gear box</li> <li>- 4 and 5-speed gear box</li> </ul> </li> <li>- Conventional gear box in front wheel drive system (transaxle):               <ul style="list-style-type: none"> <li>- Gear box parts</li> <li>- Operation of synchronizer and gears in transaxle</li> <li>- Shifting mechanism in transaxles (synchronizer units – shift fork – stabilizing rings – shift lever)</li> </ul> </li> <li>- Lubrication in conventional gear boxes</li> <li>- Vehicle speed indicator</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Drive shafts and joints:</b> <ul style="list-style-type: none"> <li>- Drive shafts in rear wheel drive system</li> <li>- Function and types of drive shafts (propeller shafts)</li> <li>- Drive shaft operation</li> <li>- Universal joints and types</li> <li>- Central support bearings</li> <li>- Drive shafts in front and four wheel drive systems</li> <li>- Constant velocity joints and types</li> </ul>	Written questions Oral questions Self test
4	<b>Final drive and axles:</b> <ul style="list-style-type: none"> <li>- Axle housing and types</li> <li>- Differential set: functions and parts</li> <li>- Methods of differential lock</li> <li>- Pinion and annular gear</li> <li>- Gear reduction in final drive</li> <li>- Limited slip differential</li> <li>- Lubrication in differential gear housing</li> <li>- Axles</li> <li>- Types of axles in rear wheel drive system (floating – semi-floating – full floating)</li> <li>- Axles in front and four wheel drive system</li> </ul>	
6	<b>Four wheel and all wheel drive systems:</b> <ul style="list-style-type: none"> <li>- Purpose of four wheel drive</li> <li>- Components of four wheel drive system</li> <li>- Parts and operation of transfer case</li> <li>- Lubrication in transfer gear box</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Vehicle power transmission systems:</b> <ul style="list-style-type: none"> <li>- Safety rules in transmission workshops</li> <li>- Correct use of tools, equipment, apparatus, and vehicle lifts</li> <li>- Identification of the parts of different power transmission models (clutch – gear box – drive shafts – final drive)               <ul style="list-style-type: none"> <li>- Friction clutch and different types</li> <li>- Sliding and constant mesh gear box</li> <li>- Different types of propeller shafts and joints</li> <li>- Final drive: components and importance</li> <li>- Shafts and axles</li> </ul> </li> <li>- Preparation of achieved job report</li> </ul>	Direct observation (practical performance) Oral questions
4	<b>Checking the conditions of oils, grease, and oil seals of different transmission models:</b> <ul style="list-style-type: none"> <li>- Checking oil leakage in one of the power transmission unit (clutch – gear box – drive shafts)</li> <li>- Checking transmission fluid level and condition in power transmission units (clutch – gear box – rear axle)</li> <li>- Preparation of technical report of the achieved job</li> </ul>	
6	<b>Clutch maintenance and repair:</b> <ul style="list-style-type: none"> <li>- Detecting sources of noise in the clutch and diagnosing faults and determining their types (mechanical or hydraulic) and the methods of measurements in the workshop using special tools and equipment</li> <li>- Clutch adjustment</li> <li>- Disassembling and checking the clutch and replacement of damaged parts</li> <li>- Checking flywheel and replacing annular gear if necessary</li> <li>- Detecting clutch faults:               <ul style="list-style-type: none"> <li>- Wear in clutch disc, pressure plate, or flywheel</li> <li>- Glazed surface of clutch disc, pressure plate, or flywheel</li> <li>- Oil on clutch disc, pressure plate, or flywheel</li> </ul> </li> </ul>	



Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Buckling in clutch disc, pressure plate, or flywheel</li> <li>- Weak springs or bent release levers</li> <li>- Clutch faults during engagement and disengagement</li> <li>- Shaking during engagement</li> <li>- Clutch pedal pulsation and hardness</li> <li>- Reinstalling the clutch and final check</li> <li>- Checking, testing, and repair of clutch release mechanism (mechanical and hydraulic)</li> <li>- Preparation of technical report of the achieved job</li> </ul>	
12	<p><b>Maintenance and repair of conventional (manual) gear boxes:</b></p> <ul style="list-style-type: none"> <li>- Detecting sources of noise in the gear box and diagnosing faults and determining their types (mechanical or hydraulic) and the methods of measurements in the workshop using special tools and equipment</li> <li>- Disassembling and checking the gear boxes and replacement of damaged parts</li> <li>- Detecting faults of constant and sliding mesh gearbox:               <ul style="list-style-type: none"> <li>- Wear in bearings</li> <li>- Damage and distortion of the splines</li> <li>- Wrong installation of parts (flanges, gears, bushings ... etc)</li> <li>- Wear in the cone clutch of synchronizer block</li> <li>- Oil leakage in the gearbox</li> <li>- Presence of noise in all shifts</li> <li>- Hard gear shifting or a metallic squealing sound</li> <li>- Complete or partial breaking of the clutch fork</li> </ul> </li> <li>- Adjusting gear teeth clearances</li> <li>- Reassembling the gearbox and testing it</li> <li>- Checking control arms and levers of manual gear box</li> <li>- Checking the condition and performance of used gears, connections, bearings, oil seals, in constant and sliding mesh gear box using special tools and equipment and replacing faulty parts and reviewing standard specification for replaced parts</li> <li>- Preparation of technical report of the achieved job</li> </ul>	<p>Direct observation (practical performance) Oral questions</p>

Detailed Practical Course		
Hours	Content	Evaluation Tools
8	<b>Fault diagnosis, repair, and adjustment of propeller shafts:</b> <ul style="list-style-type: none"> <li>- Introduce the trainee to the parts and types of propeller shafts and universal joints and the methods of faults detection and determination of their types using special tools and equipment including: <ul style="list-style-type: none"> <li>- Bending in the propeller shaft</li> <li>- Excessive clearance in the universal joints</li> <li>- Noise in the center bearing</li> <li>- Faulty ball bearing</li> </ul> </li> <li>- Determination of joints faults during rotation</li> <li>- Replacement of universal joints</li> <li>- Installation of propeller shaft</li> <li>- Checking propeller shaft balancing and inclination angle</li> <li>- Adjustment, repair or replacement of faulty parts and reviewing standard specifications for the replaced one</li> <li>- Preparation of technical report of the achieved job</li> </ul>	Direct observation (practical performance) Oral questions
10	<b>Checking, repair, and calibration of final drive (differential):</b> <ul style="list-style-type: none"> <li>- Methods of checking condition and calibration of differential as per specifications. Also, methods of locating faults and determining their types using the special tools and equipment. The faults include: <ul style="list-style-type: none"> <li>- Pinion gear</li> <li>- Crown gear</li> <li>- Differential carrier</li> <li>- Loud noise at starting or during shifting</li> <li>- Knocking sound</li> <li>- Vehicle noise and vibration during operation</li> <li>- Noise during acceleration or cornering</li> <li>- Uneven tire wear</li> <li>- Road traction problems</li> <li>- Low traction effort</li> </ul> </li> <li>- Disassembly of differential, checking, reassembly, and adjustment of clearance</li> <li>- Adjustment, repair or replacement of faulty parts and reviewing the specifications for the replaced one</li> <li>- Preparation of technical report of the achieved job</li> </ul>	
4	<b>Checking and testing axles:</b>	Direct observation (practical performance)

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Method of checking and testing axels in front and rear wheel drive systems with checking of the axle sensors and determining their condition using the special tools and equipment.</li> <li>- Types of installations of rear axle shafts</li> <li>- Conventional differential axle</li> <li>- Limited slip differential axle</li> <li>- Adjustment, repair or replacement of faulty parts and reviewing the specifications for the replaced one</li> <li>- Preparation of technical report of the achieved job</li> </ul>	Oral questions
4	<b>Transfer gear box (transfer case):</b> <ul style="list-style-type: none"> <li>- Removal of transfer gear box unit</li> <li>- Checking parts of transfer gear box</li> <li>- Replacement of faulty parts</li> <li>- Preparation of technical report of the achieved job</li> </ul>	

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- 1- Stockel, M.W., Stockel, M.T, and Johanson C., "Auto Fundamentals", Goodheanwillcox Company, Inc., ISBN 1-56637-138-4, 1996
- 2- Duffy, James E., "Modern Automotive Technology" The GoodheartWillcox company, Inc, ISBN 0-87006-043-0,1994
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- 14- Jack Enjavec and Robert Scharif "Automotive Technology" Delmar Publishers, An International Thomson Publishing Company.

Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Fuel systems (gasoline)	Code	253 MEV					
Prerequisite	172 MEV							
<b>Course description:</b> This course covers the principles of combustion in gasoline engines and the requirements of air fuel mixture, with the explanation of the basics of conventional and electronically controlled fuel delivery systems, and modern injection systems their types, components and functions). The course also contains methods of fault diagnosis, repair, adjustment, maintenance and replacement of faulty parts.								
		Trimester		1	2	3	4	5
		Credit hours					4	
		Contact hours	L				2	
			W				4	
T				-				
<b>General course objective:</b> The course aims at preparing the trainees to deal with fuel delivery systems: conventional, electronically controlled, and modern injection systems from the view point of maintenance, repair, adjustment of these systems using different tools and equipment.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>								
1) Calibrate suitable fuel/air mixture for different vehicle engine operating conditions.		- Calibration of fuel systems and adjustment of air/fuel mixture according to specifications			<b>H5</b>			
2) Deal with different types of conventional and electronically controlled carburetors.		- Service and maintenance of different types of conventional and electronically controlled carburetors			<b>H5</b>			
3) Deal with different systems of fuel injection in gasoline engines.		- Service and maintenance of different systems of fuel injection in gasoline engines			<b>H5</b>			
4) Perform fault diagnosis and detection using suitable test equipment		- Using of test and diagnostic equipment according to recommended procedure			<b>D8, B5..B8</b>			

<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <ol style="list-style-type: none"> <li>1) Explain combustion requirements related to different vehicle engines operating conditions.</li> <li>2) Identify conventional and electronically controlled fuel delivery systems.</li> <li>3) Identify different types of modern injection systems.</li> </ol>	<ul style="list-style-type: none"> <li>- Explanation of the combustion requirements related to different vehicle engine operating conditions</li> <li>- Explanation of the conventional and electronically controlled fuel delivery systems</li> <li>- Explanation of types of modern injection systems</li> </ul>	<p><b>H5</b></p> <p><b>H5</b></p> <p><b>H5</b></p>
<p><b>Safety Requirements:</b>          Complete compliance with safety rules and instructions inside gasoline fuel workshops especially those related to the disposal of exhaust gases and procedures of dealing with flammable materials.</p>		
Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Combustion principles in gasoline engine and fuel mixture requirements</li> <li>- Conventional and electronically controlled gasoline fuel delivery systems</li> <li>- Fuel injection systems: types, advantages, components, and function</li> <li>- Fault inspection, repair, adjustment of fuel delivery systems</li> <li>- Replacement of faulty parts of gasoline fuel delivery systems</li> </ul>	<p><b>H5, D8, B5, B6, B7, B8</b></p>	<ul style="list-style-type: none"> <li>- Check fuel systems (different types – components – operation – advantages and disadvantages – common faults and method of repair)</li> </ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Gasoline engine fuel delivery systems:</b> <ul style="list-style-type: none"> <li>- The fundamentals of combustion and the requirements of air fuel mixture</li> <li>- Gasoline fuel properties</li> <li>- Octane No. and detonation</li> <li>- Fuel / air ratio and its variations</li> <li>- Air fuel mixture requirements under different engine operating conditions</li> <li>- Introduction to gasoline engine fuel systems (conventional and electronic injection systems), their classifications and the comparison between them</li> <li>- Advantages of fuel injection in gasoline engines</li> </ul>	Written questions Oral questions Self test
2	<b>Conventional fuel system components:</b> <ul style="list-style-type: none"> <li>- Fuel tank</li> <li>- Fuel quantity indicator</li> <li>- Fuel filters</li> <li>- Fuel pumps (mechanical – electrical)</li> <li>- Common faults in filters and pumps</li> </ul>	
2	<b>Fundamentals of carburetors in conventional systems of fuel delivery:</b> <ul style="list-style-type: none"> <li>- Function of carburetors</li> <li>- Types of carburetors</li> <li>- Operation principles of simple carburetor</li> <li>- Basic components and circuits in carburetor operation and their functions</li> <li>- Different types of carburetors</li> <li>- Common faults in carburetors</li> </ul>	
2	<b>Mechanical fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Components and parts of the system and their functions</li> <li>- Electrical circuit and safety circuit in the system</li> <li>- Method of mechanical injector operation</li> <li>- Common faults in the system and possible causes of system problems</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Electro-mechanical fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Components and parts of the system and their functions</li> <li>- Function and operation of electronic control units</li> <li>- Sensors used with the system and the function of each</li> <li>- Electrical circuits and safety circuits in the system</li> <li>- Common faults in the system and possible causes of system problems</li> </ul>	Written questions Oral questions Self test
5	<b>Intermittent fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Introduction to the electronic fuel injection systems and the advantages of using them</li> <li>- Intermittent fuel injection: single and multi point injection and the difference between them</li> <li>- Central fuel injection system and its method of operation</li> <li>- Method of electronic injector (electromagnetic) operation</li> <li>- Different types of central injection systems of fuel and the difference between them</li> <li>- For each system the following are to be covered: <ul style="list-style-type: none"> <li>- System characteristics, circuit diagrams, system components, and modes of operation</li> <li>- Schematic diagrams for the control unit, input sensors, and output actuators</li> <li>- Diagram of injector pulse timing</li> <li>- Different operating conditions</li> <li>- Common faults in the system and possible causes of system problems</li> </ul> </li> </ul>	
5	<b>Combined electronic fuel injection and ignition systems:</b> <ul style="list-style-type: none"> <li>- Their advantages, characteristics, schematic diagrams, system components, mode of operation</li> <li>- Explanation of electronic ignition circuit within the system</li> <li>- Explanation of electronic injection circuit within the system</li> <li>- Schematic diagram to measure fuel quantity</li> <li>- Injection period and pulse timing</li> <li>- Different system operating conditions</li> <li>- Faults and possible causes of system problems</li> </ul>	



Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Modern fuel injection systems:</b>  - Explanation of modern and up to date systems of fuel injections	Written questions Oral questions Self test

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Method of applying safety instructions in automotive shops:</b> <ul style="list-style-type: none"> <li>- Method of applying general instructions</li> <li>- Practical applications on gasoline engine fuel delivery systems workshop when performing practical training of testing, maintaining, and repairing of systems</li> <li>- Acquaintance of gasoline fuel systems workshop, its contents, and different apparatus</li> </ul>	Direct observation (practical performance) Oral questions
8	<b>Maintenance and repair of conventional fuel delivery systems:</b> <ul style="list-style-type: none"> <li>- Identification of the components and parts of the conventional fuel delivery circuit and its different types (fuel tank, filters, pumps)</li> <li>- Carrying different tests on vehicle engine to identify the mixture ration and its effect on the engine and the environment</li> <li>- Removing and cleaning the air filter</li> <li>- Replacement of fuel level indicator unit (tank float)</li> <li>- Dismantling and reinstalling: fuel pump (mechanical/electrical) and filter, and checking fuel circuit</li> <li>- Checking and repairing gasoline fuel pump, filter, connections, and accelerator pedal.</li> <li>- Dismantling and reinstalling carburetor</li> <li>- Checking and repairing carburetor</li> <li>- Replacement of faulty parts in the system</li> <li>- Checking the system after replacement and repair</li> </ul>	
8	<b>Fuel pumps and injectors:</b> <ul style="list-style-type: none"> <li>- Acquaintance of different types of pumps and injectors</li> <li>- Checking, testing, and replacement of pumps</li> <li>- Checking, testing, and replacement of injectors</li> </ul>	
4	<b>Maintenance and repair of mechanical fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Identification of system components and parts</li> <li>- Checking and testing fuel regulator</li> <li>- Checking and testing engine warming up regulator</li> <li>- Replacement of faulty parts and testing using apparatus</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Maintenance and repair of mechanical fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Identification of system components and parts</li> <li>- Checking and testing sensors and switches</li> <li>- Checking and testing fuel regulator</li> <li>- Replacement of faulty parts and testing using the apparatus</li> </ul>	Direct observation (practical performance) Oral questions
12	<b>Maintenance and repair of electronic fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Identification of system components and parts</li> <li>- Checking and testing sensors and filters</li> <li>- Checking and testing regulators and electrical connections</li> <li>- Checking and testing electronic control unit</li> <li>- Replacement of faulty parts and testing using apparatus</li> </ul>	
12	<b>Combined electronic fuel injection and ignition systems:</b> <ul style="list-style-type: none"> <li>- Identification of system components and parts</li> <li>- Checking and repairing sensors and regulators</li> <li>- Replacement of faulty parts and final checking using apparatus</li> <li>- Checking and repairing ignition system part</li> <li>- Checking distributor, ignition coil, spark plugs, connections, electronic components, spark plug cables, ignition system sensors</li> <li>- Checking control unit for the combined system</li> <li>- Replacement of faulty parts in the combined system</li> <li>- Final check of the combined system</li> </ul>	

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Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Fuel systems (Diesel)	Code	261 MEV					
Prerequisite	172 MEV							
<b>Course description:</b> The course presents a study of different types of diesel fuel injection systems, their components and operation including: fuel tank, delivery pump, filters, fuel pumps, injectors, and electronic control of diesel engines. The practical part of the course includes methods of fault diagnosis, repair, and adjustment of diesel fuel injection components.								
		Trimester		1	2	3	4	5
		Credit hours						3
		Contact hours	L					2
			W					2
T						-		
<b>General course objective:</b> The course aims at introducing the trainee to the different types of diesel fuel injection systems, their components, parts and operation of these components and parts, in addition to training on fault diagnosis, inspection, repair, and adjustment of the system elements.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Perform repair and replacement of different types of fuel filters and delivery pumps.  2) Diagnose performance faults and adjust injection system.  3) Adjust and calibrate different types of injection pumps on the fuel pump test bench.  4) Adjust and calibrate injectors.		 - Operation of filters and delivery pumps correctly  - Diagnosis of injection system faults and determination of causes and perform required adjustment  - Adjustment and calibration of injection pumps according to manufacturer manual  - Adjustment and calibration of injectors according to manufacturer manual			 <b>M1, M6</b>  <b>M4, M5, M7</b>  <b>M14</b>  <b>M10</b>			

5) Repair pumps and injectors and replace faulty parts if required	- Replacement of faulty parts and repair of pumps and injectors and operation according to specifications	<b>M3, M9, M10, M11</b>
6) Replace electronic fuel injection system components.	- Replacement of electronic injection system elements according to specifications	<b>M8, M12</b>
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Arrange required tools and prepare work places.	- Preparation of workplace and arrange required tools	<b>A2, A3</b>
2) Know the types and parts of diesel fuel injection systems.	- Identification of types and parts of diesel fuel injection system	<b>M4, M5, M7</b>
3) Read manufacturer manual and determine the specifications of pumps and injectors.	- Determination of the specifications of pumps and injectors according to manufacturer manual	<b>M9, M10, M13</b>
<b>Safety Requirements:</b> <ul style="list-style-type: none"> <li>- Compliance with safety instructions given in user manuals of pumps and injectors testing equipment.</li> <li>- Compliance with safety instructions in diesel workshops.</li> </ul>		
<b>Subjects (Theoretical and Practical)</b>	<b>Related Tasks</b>	
- Fuel injection systems in diesel engines	<b>M7</b>	- Check fuel system circuit
- Fuel delivery pumps	<b>M6</b>	- Repair delivery pump
- Filters	<b>M1</b>	- Replace filters
- Fuel injection pumps (high pressure pumps)	<b>M3, M11</b>	- Repair diesel pump attachments - Replace injection units
- Injectors		

<ul style="list-style-type: none"><li>- Electronic control in diesel fuel injection systems</li><li>- Fault diagnosis, repair, and adjustment of diesel fuel injection system elements</li></ul>	<b>M8, M12</b>	<ul style="list-style-type: none"><li>- Check electronic injection system</li><li>- Replace electronic injection system components</li></ul>
	<b>M1, M13</b>	<ul style="list-style-type: none"><li>- All tasks related to the duty: repair diesel fuel system faults</li></ul>



Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Fundamentals of fuel injection in diesel engines:</b> <ul style="list-style-type: none"> <li>- Comparison between gasoline and diesel engines</li> <li>- Classifications of diesel engines</li> <li>- Diesel fuel characteristics</li> <li>- Combustion stages in diesel engines</li> <li>- Method of fuel injection (direct and indirect injection)</li> <li>- Combustion chambers in diesel engines (direct, swirl and pre-chambers – heater plugs)</li> <li>- Supercharging in diesel engines</li> <li>- Diesel engine knock</li> </ul>	Written questions Oral questions Self test
2	<b>Fuel injection systems in diesel engines</b> <ul style="list-style-type: none"> <li>- Fuel delivery system types</li> <li>- Fuel injection system components (fuel tank – delivery pump – fuel filters – injection pump – pipes – injectors)</li> </ul>	
4	<b>Fuel delivery (supply) pumps:</b> <ul style="list-style-type: none"> <li>- Fuel supply pump types</li> <li>- Construction and operation of supply pumps</li> <li>- Faults in supply pumps</li> </ul>	
2	<b>Fuel filters:</b> <ul style="list-style-type: none"> <li>- Fuel filters types and materials</li> <li>- Fuel path in filters</li> <li>- Effect of filters on injection system faults</li> </ul>	
4	<b>Fuel injection pumps (high pressure pumps):</b> <ul style="list-style-type: none"> <li>- Function of the pump</li> <li>- Types of in-line and distributor pumps</li> <li>- Construction and operation of the in-line injection pump</li> <li>- Construction and operation of the distributor injection pump</li> <li>- Methods of controlling fuel injection in in-line pump</li> <li>- Methods of controlling fuel injection in distributor pump</li> <li>- Method of testing and adjusting the in-line pump</li> <li>- Methods of testing and adjusting the distributor pumps</li> <li>- Governors (mechanical – hydraulic – pneumatic – electric)</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Injectors:</b> <ul style="list-style-type: none"><li>- Types of the injectors</li><li>- Construction and operation of the injector</li><li>- Methods of testing and adjusting injectors</li></ul>	Written questions Oral questions Self test
6	<b>Electronic control of diesel fuel injection systems (EDC)</b> <ul style="list-style-type: none"><li>- Types of electronic control systems in in-line and distributor injection pumps and method of operation</li><li>- Electronic control system components (sensors – actuators – control unit)</li><li>- Method of system operation</li><li>- the injectors</li></ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Components of diesel fuel injection systems:</b> <ul style="list-style-type: none"> <li>- Safety procedures in diesel workshops</li> <li>- Identification of tools and equipment in shops</li> <li>- Use of service and maintenance catalogues</li> <li>- Checking the performance of injection system on vehicle</li> <li>- Removing the injection pump from the vehicle</li> <li>- Dismantling and reinstalling injection system components (tank – supply pump – filters – injection pumps – pipes – injectors)</li> </ul>	Direct observation (practical performance) Oral questions
2	<b>Adjustment, repair, and replacement of different types of:</b> <ul style="list-style-type: none"> <li>- Fuel filters</li> <li>- Supply pumps</li> <li>- Heating plugs</li> </ul>	
4	<b>Testing of diesel injection fuel pump systems on diesel engine test bench:</b> <ul style="list-style-type: none"> <li>- Simulation of faults in diesel injection systems and determination of causes such as: hard starting, loss in engine power, irregular rotation, noise due to engine knock</li> <li>- Eye inspections for pipes and electrical connections to determine leakage and faults</li> <li>- Testing and adjusting injection timing</li> <li>- Testing diesel smoke (exhaust)</li> <li>- Air bleeding from the injection system</li> <li>- Repair and replacement of supply lines (high pressure pipes – return pipes – filters)</li> </ul>	
2	<b>Adjustment, repair and testing of injectors:</b> <ul style="list-style-type: none"> <li>- Disassembling and cleaning the injector, and reassembling and installing</li> <li>- Checking and repairing the injector</li> <li>- Testing the injector (leakage – start injection pressure – dribbling – atomization)</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Test and adjustment of in-line pump:</b> <ul style="list-style-type: none"> <li>- Use of high pressure pump test bench to determine: leakage – rack position – fuel cut off point – supply quantity at different speeds and rack positions</li> <li>- Comparison of the results with manufacturer manual</li> </ul>	Direct observation (practical performance) Oral questions
4	<b>Test and adjustment of distributor pump:</b> <ul style="list-style-type: none"> <li>- Use of high pressure pump test bench to test: transfer pump – automatic advance – leakage – maximum fuel delivery – fuel cut off – governor position adjustment – timing adjustment)</li> <li>- Comparison of the results with manufacturer manual</li> </ul>	
4	<b>Repair of in-line and distributor injection pumps:</b> <ul style="list-style-type: none"> <li>- Replacement of faulty parts in diesel injection pumps including:               <ul style="list-style-type: none"> <li>- Injection elements</li> <li>- Cam plate</li> <li>- Springs</li> <li>- Injection timer spring</li> <li>- Delivery valves</li> </ul> </li> <li>- Installing the pump and adjusting injection timing on the vehicle</li> </ul>	
4	<b>Checking and replacement of electronic control system components of diesel fuel injection:</b> <ul style="list-style-type: none"> <li>- Inspection of system components (sensors – actuators – control unit)</li> <li>- Replacement of control system components</li> </ul>	

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Department	Mechanical Technology	Major	Engines and Vehicles																															
Course name	Ignition Systems	Code	252 MEV																															
Prerequisite	171 & 172 MEV																																	
<b>Course description:</b> This course provides the trainees with the principles of ignition systems and the different types of the system components, with explanation of the characteristics, parts, and operation of ignition circuits. The trainees will be trained practically on the methods of dealing with different ignition circuits regarding inspection, adjustment, maintenance, and repair of system parts, and will be given the skills to follow up faults and repair them.		<table><tr><td>Trimester</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Credit hours</td><td></td><td></td><td></td><td>3</td><td></td></tr><tr><td rowspan="3">Contact hours</td><td>L</td><td></td><td></td><td>2</td><td></td></tr><tr><td>W</td><td></td><td></td><td>2</td><td></td></tr><tr><td>T</td><td></td><td></td><td>-</td><td></td></tr></table>					Trimester	1	2	3	4	5	Credit hours				3		Contact hours	L			2		W			2		T			-	
Trimester	1	2	3	4	5																													
Credit hours				3																														
Contact hours	L			2																														
	W			2																														
	T			-																														
<b>General course objective:</b> This course aims at giving the trainees basic skills required to perform inspection, replacement, and repair of ignition circuit parts, and perform required adjustment and maintenance using testing and diagnostic equipment.																																		
Detailed Objectives		Required Performance Specifications			Related Tasks																													
<b>First: Procedural Objectives:</b> The trainees should be able to:  1) Check ignition circuits.  2) Perform required maintenance on ignition systems.  3) Test ignition system performance  4) Repair ignition systems.		Correctly inspection of: - parts operation – ground terminal – open circuit – resistance – parts conditions – clearance adjustment – parts replacement – road testing the vehicle – using testing and diagnostic equipment – parts removal – parts measurement – determination of type of required repair – reinstalling parts after repair			D10, L1..L3  L4  B3, B5, B7, H7  B6, B8, L5, L6																													

<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Explain the principles of ignition circuit operations.	- Explanation of the principles of ignition system and theory of operation	<b>L1..L4</b>
2) Identify parts of primary circuits and their operations.	- Explanation of primary circuit parts operations	<b>L1..L4</b>
3) Identify parts of secondary circuits and their operations.	- Explanation of secondary circuit parts operations	<b>L1..L4</b>
4) Identify parts of spark advance system and their operations.	- Explanation of spark advance system parts operations	<b>L1..L4</b>
5) Define ignition system periodic maintenance and the required equipment to perform it.	- Identification of maintenance tasks and procedures, and types of used equipment	<b>D10, H6, H7, L5</b>
<b>Safety Requirements:</b> <ul style="list-style-type: none"> <li>- Consideration of personal safety and the safety of equipment and vehicles.</li> <li>- Caution when dealing with high tension voltage of the spark and condenser electrical charge.</li> </ul>		
<b>Subjects (Theoretical and Practical)</b>	<b>Related Tasks</b>	
<ul style="list-style-type: none"> <li>- Ignition system fundamentals</li> <li>- Service of the primary circuits</li> <li>- Service of the secondary circuits</li> <li>- Ignition system faults and problems</li> <li>- Methods and equipment of ignition system testing</li> <li>- Ignition system maintenance program</li> </ul>	<b>L2, L3, D10</b>	- Checking and adjustment of parts
	<b>L4</b>	- Replacement and maintenance of parts
	<b>H6, L5</b>	- Repair parts



Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Ignition system in vehicles:</b> <ul style="list-style-type: none"> <li>- Principles of ignition</li> <li>- Effect of ignition and timing on engine performance</li> <li>- Firing order</li> <li>- System components               <ul style="list-style-type: none"> <li>- Ignition primary circuit</li> <li>- Ignition secondary circuit</li> <li>- Automatic advance of ignition timing</li> </ul> </li> <li>- Ignition systems classification</li> </ul>	Written questions Oral questions Self test
6	<b>Conventional ignition systems (mechanical):</b> <ul style="list-style-type: none"> <li>- Theory of operation of conventional ignition system</li> <li>- Parts of conventional ignition system circuit</li> <li>- Function and operation of conventional ignition system components and parts</li> </ul>	
6	<b>Semi-electronic ignition systems:</b> <ul style="list-style-type: none"> <li>- Advantages of the system to solve previous systems problems</li> <li>- Transistorized system</li> <li>- Hall effect system</li> <li>- Inductive system</li> <li>- Optical system</li> </ul>	
4	<b>Electronic ignition systems:</b> <ul style="list-style-type: none"> <li>- Advantages of the system to solve previous systems problems</li> <li>- Controlling of spark timing electronically</li> <li>- Electronic ignition with high voltage distributor (distributor ignition)</li> <li>- Electronic ignition without high voltage distributor (distributorless ignition)</li> </ul>	
2	<b>Discharge condenser ignition system:</b> <ul style="list-style-type: none"> <li>- Theory of operation</li> <li>- Circuit components</li> <li>- Method of operation</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Method of checking ignition system and performing maintenance operations:</b> <ul style="list-style-type: none"><li>- Ignition systems problems</li><li>- Methods of checking ignition systems problems</li><li>- Equipment used and the analysis of ignition characteristic curves</li></ul>	Written questions Oral questions Self test

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Ignition workshops:</b> <ul style="list-style-type: none"> <li>- Definition of safety precautions in ignition workshops</li> <li>- Definition of measuring and diagnostic tools and equipment</li> <li>- Using catalogues</li> </ul>	Direct observation (practical performance) Oral questions
2	<b>Ignition circuits:</b> <ul style="list-style-type: none"> <li>- Identification of:               <ul style="list-style-type: none"> <li>- Types of ignition circuits</li> <li>- Ignition circuit parts</li> <li>- Circuit connections</li> </ul> </li> <li>- Eye inspections on:               <ul style="list-style-type: none"> <li>- Type of ignition circuit</li> <li>- Conditions of parts and quality of connections</li> </ul> </li> </ul>	
6	<b>Checking ignition system components (primary circuit):</b> <ul style="list-style-type: none"> <li>- Mechanical ignition system:               <ul style="list-style-type: none"> <li>- Contact points distributor (checking contact points – measuring contact points clearance/dwell angle – replacing contact breaker and condenser)</li> </ul> </li> <li>- Semi-electronic ignition system:               <ul style="list-style-type: none"> <li>- Transistorized distributor (checking connections – checking contact and interruption – checking and replacing control unit)</li> <li>- Inductive coil distributor (checking connections – checking contact and interruption – checking and replacing control unit)</li> <li>- Hall distributor (checking connections – checking contact and interruption – checking and replacing control unit)</li> <li>- Optical cell distributor (checking connections – checking contact and interruption – checking and replacing control unit)</li> </ul> </li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
8	<b>Checking ignition system components (secondary circuits):</b> <ul style="list-style-type: none"> <li>- Ignition coil: <ul style="list-style-type: none"> <li>- Checking ignition coil operation</li> <li>- Checking starting resistance operation</li> <li>- Measuring coil circuits resistances</li> </ul> </li> <li>- Spark distributor: <ul style="list-style-type: none"> <li>- Checking distributor cap</li> <li>- Checking spark distributor</li> <li>- Reinstalling distributor on engine</li> <li>- Adjusting spark timing</li> </ul> </li> <li>- High voltage wires: <ul style="list-style-type: none"> <li>- Disconnecting high voltage wires</li> <li>- Checking wires resistance</li> <li>- Reconnecting high voltage wires</li> </ul> </li> <li>- Spark plugs: <ul style="list-style-type: none"> <li>- Definition of different types</li> <li>- Definition of spark code number</li> <li>- Definition of spark specifications (heat range – screw length and diameter)</li> <li>- Dismantling spark plugs</li> <li>- Checking condition of plugs and evaluate condition of combustion in cylinders</li> <li>- Reinstall spark plugs</li> </ul> </li> </ul>	Direct observation (practical performance) Oral questions
4	<b>Checking ignition system components (automatic spark advance):</b> <ul style="list-style-type: none"> <li>- Mechanical advance: <ul style="list-style-type: none"> <li>- Checking centrifugal (speed) advance operation</li> <li>- Checking vacuum (load) advance operation</li> <li>- Total advance measurement</li> <li>- Repair and replacement of faulty parts</li> </ul> </li> <li>- Electronic advance: <ul style="list-style-type: none"> <li>- Checking sensors operation</li> <li>- Replacing faulty sensors</li> </ul> </li> <li>- Electronic ignition: <ul style="list-style-type: none"> <li>- Definition of circuit parts (distributor ignition – distributorless ignition)</li> <li>- Checking circuit and replacing parts</li> </ul> </li> <li>- Discharge condenser ignition: <ul style="list-style-type: none"> <li>- Definition of circuit parts</li> <li>- Checking condenser and method of replacement</li> </ul> </li> </ul>	Direct observation (practical performance) Oral questions

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Checking ignition circuits:</b> <ul style="list-style-type: none"><li>- Checking performance and circuit failures by observing engine performance</li><li>- Checking performance and circuit failures by using testing equipment (oscilloscope)</li></ul>	

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Department	Mechanical Technology	Major	Engines and Vehicles				
Course name	Automatic Transmissions	Code	262 MEV				
Prerequisite	173 MEV						
<b>Course description:</b> This course covers the study of conventional and electronically controlled automatic transmissions in vehicles, their components (hydraulic clutch, torque converter, and planetary gear units) with the explanation of hydraulic and electronic control circuits. Also the course contains methods of inspection, repair and replacement of faulty parts.							
		Trimester	1	2	3	4	5
		Credit hours					5
		Contact hours	L				2
			W				6
	T				-		
<b>General course objective:</b> The course aims at giving the trainees the required skills to check, repair and replace faulty parts in automatic transmissions or to carry out complete overhaul of it and perform required testing to ensure satisfactory performance.							
Detailed Objectives		Required Performance Specifications			Related Tasks		
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Check automatic transmission parts and methods of their operation (clutch and torque converter, planetary gear unit, and method of hydraulic control).  2) Check automatic transmission using test equipment (dynamometer).  3) Repair or replace faulty parts and perform transmission overhaul.  4) Test automatic transmissions after repair or overhaul.		- Ability to check automatic transmission parts and method of operation  - Carrying out check on the transmission dynamometer correctly considering safety procedures - Checking automatic transmission and locating fault  - Repair or replacement of faulty transmission parts and overhaul it  - Testing automatic transmission according to specifications			<b>I3..I7, I9, I13</b>  <b>I11</b>  <b>I3..I7, I9, I11, I13</b> <b>I11</b>		



<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Identify the automatic transmission and its role in the vehicle through visual or readable means	- Determine types of automatic transmissions and their role in the vehicle	<b>I3</b>
2) Identify transmission components (clutch and torque converter, planetary gear unit, and method of hydraulic control), and the related systems theoretically through visual and readable means and practically in automotive shops.	- Classify parts of automatic transmission in workshop - Define automatic transmission components and parts - Define the related systems of automatic transmissions	<b>I4..I7, I9, I11, I13</b>
3) Identify the method of using automatic transmission testing equipment theoretically through visual and readable means and practically in automotive shops.	- Classify automatic transmission testing equipment exist in workshops - Determine the method of using transmission testing equipment exist in the workshop.	<b>I1, I3</b>
<b>Safety Requirements:</b> Compliance with safety instructions generally found in automotive shops, and particularly found in automatic transmission workshops.		
<b>Subjects (Theoretical and Practical)</b>	<b>Related Tasks</b>	
- Automatic transmission and its role	<b>I3</b>	- Replace filter and check oil pan
- Automatic transmission construction	<b>I4..I7, I9, I11, I13</b>	- Repair transmission oil pump - Replace transmission oil pump - Replace transmission sensors - Replace hydraulic coupling or torque converter - Replace transmission oil seals and gaskets - Reprogram automatic transmission - Repair oil leakage sources
- Clutch, torque converter, and planetary gear unit	<b>I7</b>	- Replace hydraulic coupling or torque converter

<ul style="list-style-type: none"> <li>- Hydraulic control system</li> <li>- Electronically controlled automatic transmissions</li> <li>- Checking automatic transmissions</li> <li>- Repair or replacement of faulty parts in automatic transmissions</li> </ul>	<b>I4..I6, I11, I13</b>	<ul style="list-style-type: none"> <li>- Repair transmission oil pump</li> <li>- Replace transmission oil pump</li> <li>- Replace transmission sensors</li> <li>- Replace transmission oil seals and gaskets</li> <li>- Repair oil leakage sources</li> </ul>
	<b>I3..I7, I9, I11, I13</b>	<ul style="list-style-type: none"> <li>- Replace filter and check oil pan</li> <li>- Repair transmission oil pump</li> <li>- Replace transmission oil pump</li> <li>- Replace transmission sensors</li> <li>- Replace hydraulic coupling or torque converter</li> <li>- Replace transmission oil seals and gaskets</li> <li>- Reprogram automatic transmission</li> <li>- Repair oil leakage sources</li> </ul>
	<b>I3..I7, I9, I11, I13</b>	<ul style="list-style-type: none"> <li>- Replace filter and check oil pan</li> <li>- Repair transmission oil pump</li> <li>- Replace transmission oil pump</li> <li>- Replace transmission sensors</li> <li>- Replace hydraulic coupling or torque converter</li> <li>- Replace transmission oil seals and gaskets</li> <li>- Reprogram automatic transmission</li> <li>- Repair oil leakage sources</li> </ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Automatic transmissions:</b> <ul style="list-style-type: none"> <li>- Definition of automatic transmission and its components</li> <li>- Advantages of using automatic transmission</li> <li>- Types of automatic transmissions (rear drive and front drive systems)</li> </ul>	Oral questions Written questions Self test
4	<b>Hydraulic clutch and torque converter:</b> <ul style="list-style-type: none"> <li>- Function, parts, and operation of hydraulic coupling</li> <li>- Function, parts, types and operation of torque converters</li> <li>- Comparison between hydraulic coupling and torque converter</li> </ul>	
4	<b>Planetary gear units:</b> <ul style="list-style-type: none"> <li>- Identification of planetary gear unit, its components and operation</li> <li>- Methods of obtaining different gear ratios from the planetary gear unit</li> <li>- Three speed planetary gear unit and the gear ratios</li> </ul>	
2	<b>Brake clutches and bands</b> <ul style="list-style-type: none"> <li>- Types and operation of clutches</li> <li>- Components and operation of brake bands</li> </ul>	
3	<b>Hydraulic control systems:</b> <ul style="list-style-type: none"> <li>- Hydraulic control system components</li> <li>- Hydraulic control circuit</li> <li>- Oil pump</li> <li>- Types and properties of oil used in automatic transmissions</li> <li>- Automatic transmission oil filter</li> </ul>	
3	<b>Hydraulic control methods:</b> <ul style="list-style-type: none"> <li>- Regulator</li> <li>- Pressure regulator vacuum valve</li> <li>- Method of operation of the hydraulic shift control circuit</li> <li>- Transmission throttle valve</li> <li>- Manual kick down valve</li> <li>- Different pressures in the hydraulic circuit parts and their relation to valve operation, and method of calculations</li> </ul>	Oral questions Written questions Self test

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Reverse shift valve</li> <li>- 1-2 shift valve and its piston</li> <li>- 2-3 shift valve and its piston</li> </ul>	
2	<b>Power flow in automatic transmissions:</b> <ul style="list-style-type: none"> <li>- Identification of power flow in the (D) position and first shift</li> <li>- Identification of power flow in the (D) position and second shift</li> <li>- Identification of power flow in the (D) position and third shift</li> <li>- Identification of power flow in the reverse shift</li> <li>- Identification of the clutches</li> </ul>	
4	<b>Electronically controlled automatic transmission:</b> <ul style="list-style-type: none"> <li>- Components and operation of electronically controlled automatic transmission</li> <li>- Identification of sensors</li> <li>- Identification of faults in automatic transmission</li> </ul>	
2	<b>Automatic transmission oil cooler:</b> <ul style="list-style-type: none"> <li>- The need of cooling transmission oil</li> <li>- Types of transmission oil coolers</li> <li>- Operation of transmission oil cooler</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Automatic transmission workshops:</b> <ul style="list-style-type: none"> <li>- Identification of safety precautions in the automatic transmission workshops</li> <li>- Identification of the equipment and special tools</li> <li>- Dealing with service and maintenance manuals</li> </ul>	Direct observation (practical performance) Oral questions
18	<b>Automatic transmissions:</b> <ul style="list-style-type: none"> <li>- Identification of types of automatic transmission</li> <li>- Checking oil level, condition and leakage</li> <li>- Change oil and oil filter</li> <li>- Perform tests on the automatic transmission before removing from the vehicle using modern test equipment (Tech II)</li> <li>- Removing the automatic transmission from the vehicle</li> <li>- Perform tests on the automatic transmission after removing it from the vehicle using transmission dynamometer</li> </ul>	
12	<b>Checking and repairing clutch and torque converter:</b> <ul style="list-style-type: none"> <li>- Removal of the hydraulic coupling and torque converter</li> <li>- Checking the hydraulic coupling and torque converter</li> <li>- Replacing the hydraulic coupling and torque converter</li> </ul>	
12	<b>Checking and repairing oil pump and replacing filter and oil seals:</b> <ul style="list-style-type: none"> <li>- Disassembly of automatic transmission using special tools</li> <li>- Identification of the components and parts and the function of each</li> <li>- Checking, repairing, or replacing oil pump</li> <li>- Checking and repairing oil circuit</li> <li>- Replacing oil filter</li> <li>- Replacing oil seals and gaskets</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
18	<b>Checking and repairing hydraulic control system components:</b> <ul style="list-style-type: none"> <li>- Checking and replacing planetary gear unit</li> <li>- Checking and replacing clutches</li> <li>- Installing clutches using special tools</li> <li>- Checking and replacing brake bands</li> <li>- Checking pistons</li> <li>- Checking the control units</li> <li>- Reassembly of automatic transmission using suitable tools</li> <li>- Test of automatic transmission after reassembly on transmission dynamometer</li> <li>- Reinstalling transmission on the vehicle</li> <li>- Perform tests on the automatic transmission after reinstalling using modern test equipment (Tech II)</li> </ul>	Direct observation (practical performance) Oral questions
14	<b>Testing and adjusting electronically controlled automatic transmission:</b> <ul style="list-style-type: none"> <li>- Identification of electronic control circuit components (control unit – sensors – actuators)</li> <li>- Using testing equipment to identify fault code</li> <li>- Replacing faulty parts</li> <li>- Checking and replacing sensors</li> <li>- Testing performance of electronically controlled automatic transmissions</li> </ul>	

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- 11- Robert Bosch Coop, "Automotive Handbook", Bosch, VDI-Verlag, ISBN
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Department	Mechanical Technology	Major	Engines and Vehicles																															
Course name	Automotive Engines Repair	Code	263 MEV																															
Prerequisite	172 MEV																																	
<b>Course description:</b> Training in this course will cover service, maintenance, and repair of automotive engines components and parts including complete and partial overhaul after performing the required check and test, with training on using tools, equipment, and service and maintenance manuals.		<table><tr><td>Trimester</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Credit hours</td><td></td><td></td><td></td><td></td><td>4</td></tr><tr><td rowspan="3">Contact hours</td><td>L</td><td></td><td></td><td></td><td>1</td></tr><tr><td>W</td><td></td><td></td><td></td><td>6</td></tr><tr><td>T</td><td></td><td></td><td></td><td>-</td></tr></table>					Trimester	1	2	3	4	5	Credit hours					4	Contact hours	L				1	W				6	T				-
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<b>General course objective:</b> The course aims at giving the trainees the basic skills required to deal with automotive engines through performing, checking and testing using common equipment used in this field, and perform maintenance, repair, and replacement operations of engine parts.																																		
Detailed Objectives		Required Performance Specifications			Related Tasks																													
<b>First: Procedural Objectives:</b> <b>The trainees should be able to:</b>																																		
1) Determine type of required test to detect fault in vehicle engines.		- Type of test agrees with fault symptoms in the engine			<b>B1..B4, B7</b>																													
2) Perform required test to determine vehicle engine condition and check engine’s related systems.		- Testing procedure conforms with standard procedure followed in the automotive field			<b>D1..D10, B1</b>																													
3) Use equipment, instruments, and special tools for repairing vehicle engines.		- Equipment, instruments, and special tools conform with those in common use in the automotive field			<b>B5</b>																													
4) Repair engine cylinder head faults.		- Repair procedure according to required specifications			<b>H1</b>																													

5) Repair engine cylinder block faults	- Repair procedure according to required specifications	<b>H2, B8</b>
6) Repair systems related to vehicle engine operations.	- Repair procedure according to required specifications	<b>H3..H6</b>
7) Prepare report on vehicle engine conditions before and after repair.	- Preparation of report according to specifications of technical report requirements	<b>H7</b>
<b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b> <b>The trainees should be able to:</b>		
1) Choose suitable place and position in the shop and put suitable protective shields on vehicles.	- Preparation of suitable work environment	<b>C1, C2</b>
2) Select suitable cleaning material and clean part required to be repaired.	- Following up manufacturer instructions in selecting cleaning material and performing cleaning	<b>C3, C4</b>
3) Determine required spare parts.	- Specifying spare parts according to specifications	<b>B8</b>
4) Follow manufacturer instructions when performing maintenance and repair operations.	- Arrangement of maintenance and repair operations in accordance with manufacturer's instructions and specifications	<b>C5</b>
<b>Safety Requirements:</b> Full compliance with safety instructions in automotive shops (related tasks: from A1 to A9)		
Subjects (Theoretical and Practical)	Related Tasks	
- Tests to determine vehicle engine conditions and its related systems.	<b>D1..D10</b>	- All tasks related to the duty: Determine faults in engine
- Measurement of engine pressures.	<b>D6</b>	- Measure engine compression pressure
- Equipment, instruments, and special tools for vehicle engine repairs.	<b>B5</b>	- use test equipment to determine car faults

<ul style="list-style-type: none"> <li>- Engine disassembly and cleaning of its components and parts</li> <li>- Repair and reassembly of engine cylinder head</li> <li>- Repair and reassembly of engine cylinder blocks</li> <li>- Preparation of reports on vehicle engine conditions before and after repair operations</li> </ul>	<b>B6, C3, C4</b>	<ul style="list-style-type: none"> <li>- Disassemble some parts if needed</li> <li>- Choose suitable cleaning materials</li> <li>- Clean parts to be repaired with proper cleaning materials</li> </ul>
	<b>B8, H1</b>	<ul style="list-style-type: none"> <li>- Determine the required spare parts</li> <li>- Repair faults in cylinder head</li> </ul>
	<b>B8, H2</b>	<ul style="list-style-type: none"> <li>- Determine the required spare parts</li> <li>- Repair faults in cylinder</li> </ul>
	<b>H7</b>	<ul style="list-style-type: none"> <li>- Fill in the final job sheet</li> </ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Introduction:</b> <ul style="list-style-type: none"> <li>- Materials of vehicle engine</li> <li>- Methods of manufacturing vehicle engine</li> <li>- Gaskets: types, their use, and materials</li> <li>- Adhesive materials, oil seals, chemical materials for preventing leakage</li> <li>- Oil seals</li> <li>- Fundamentals of tightening torque in automotive engines</li> <li>- Tightening means in automotive engines</li> <li>- Cracks (causes, and methods of detection and repair)</li> </ul>	Oral questions Written questions Self test
2	<b>Sources of engine faults:</b> <ul style="list-style-type: none"> <li>- Sources and causes of leaks in vehicle engine</li> <li>- Lubricating oil consumption and its causes</li> <li>- Engine hard starting problems</li> <li>- Locations that cause noise in vehicle engine and attachments</li> <li>- Failure in related systems to engine operation (lubrication system – cooling system – fuel system – ignition system – exhaust system)</li> </ul>	
4	<b>Meanings of engine condition determination tests:</b> <ul style="list-style-type: none"> <li>- A concept should be given about the equipment used and the method of performing the following tests and the meanings of the results for each:</li> <li>- Tests of measuring automotive engine pressures:               <ul style="list-style-type: none"> <li>- Compression test</li> <li>- Loss of compression test (compression leakage test in engine cylinder)</li> <li>- Vacuum test in suction manifold</li> <li>- Lubricating oil pressure test</li> <li>- Pressure test in cooling system</li> </ul> </li> <li>- Other tests to determine engine condition               <ul style="list-style-type: none"> <li>- Power balance test (cylinder power balance)</li> <li>- Exhaust gas analysis test</li> </ul> </li> <li>- Determination of engine condition after performing previous tests and recognition whether the engine needs maintenance or repair, and what kind of work should be done to the engine</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Special tools and equipment for engine maintenance and repair:</b> <ul style="list-style-type: none"> <li>- General and special measuring tools</li> <li>- Equipment and repairing supplies (specialized for cylinder head, cylinder block, crankshaft, connecting rod, piston, piston rings, and piston pin)</li> <li>- Special hand tools</li> <li>- Service and maintenance manuals and methods of using them</li> </ul>	Oral questions Written questions Self test
3	<b>Engine repair strategy:</b> <ul style="list-style-type: none"> <li>- Difference between complete overhaul and partial (semi) overhaul of vehicle engine and time of performing them</li> <li>- Removing the engine from the vehicle</li> <li>- Disassembly of the engine cylinder head (in case the engine in place in the vehicle, and the engine out)</li> <li>- Disassembly of the engine cylinder block</li> <li>- Cleaning engine components and parts</li> <li>- Carrying out required check and measurements on engine components and parts</li> <li>- Comparing measured values with standard values according to service and maintenance manual</li> <li>- Final declaration on the condition of engine parts as they either need repair or replace</li> <li>- Method of determination of spare parts for any part of engine components</li> <li>- Repair of engine cylinder head and its attachment and reassembly, with adjustment of clearances during reassembly operation</li> <li>- Repair of engine cylinder block and its attachment and reassembly, with adjustment of clearances during reassembly operation</li> <li>- Repair what is required in the systems related to engine operation</li> <li>- Reassembly of vehicle engine and installation of timing gear assembly and engine attachments</li> <li>- Installing the engine in place in the vehicle</li> <li>- Adjustment of the engine in the vehicle</li> <li>- Vehicle engine softening</li> <li>- Testing the engine on the engine dynamometer</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
4	<b>Method of applying safety instructions in automotive workshops:</b> <ul style="list-style-type: none"> <li>- Method of applying general instructions</li> <li>- Practical applications of the instructions on engine maintenance and repair workshops when starting practical training of the course</li> </ul>	Oral questions
8	<b>Identification of special tools and equipment for engine maintenance and repair and methods of using them:</b> <ul style="list-style-type: none"> <li>- Measuring tools</li> <li>- Equipment and repair supplies for repairing engine cylinder head</li> <li>- Equipment and repair supplies for repairing engine cylinder block</li> <li>- Equipment and repair supplies for repairing crankshaft</li> <li>- Equipment and repair supplies for repairing pistons and connecting rods</li> <li>- Special hand tools</li> <li>- Basic general hand tools in automotive shops</li> <li>- Service and maintenance manuals</li> </ul>	Direct observation (practical performance) Oral questions
12	<b>Performing engine pressure tests to determine sources of vehicle engine faults:</b> <ul style="list-style-type: none"> <li>- Instruments used to perform engine tests</li> <li>- Performing engine tests and analyzing of results:</li> <li>- Compression test</li> <li>- Loss of compression test (compression leakage test in engine cylinders)</li> <li>- Vacuum test in suction manifold</li> <li>- Pressure test in cooling system</li> <li>- Power balance test (engine cylinder power balance)</li> <li>- Exhaust gas analysis test</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
12	<b>Dismantling the vehicle engine out of its place and disassembling and cleaning it:</b>  (Always use maintenance and repair catalogues and consider using suitable tools) - Disconnect engine removal barriers from place - Removing vehicle engine from its place (front drive and rear drive engines) - Placing vehicle engine on its special stand - Disassembling engine cylinder head (for engine with overhead valves and engines with overhead camshafts) - Disassembling engine cylinder block - Cleaning engine components and parts in accordance with service and maintenance manuals - Placing components and parts on their special stands and tables considering arrangement when placing them - Writing technical report of the achieved done job	Direct observation (practical performance) Oral questions
10	<b>Repairing engine cylinder head:</b>  (Always use maintenance and repair catalogues and consider using suitable tools) - Checking flatness of aluminum made cylinder head and the adjacency of over head camshaft bearings - Repairing and replacing valve guides - Repairing valve seats - Repairing valves and method of reconditioning them - Repairing timing system components - Writing technical report of the achieved done job	
14	<b>Repairing engine cylinder block:</b>  (Always use maintenance and repair catalogues and consider using suitable tools) - Checking flatness of cylinder block surface - Checking and determining repair of cylinders - Checking and determining repair of bearings - Checking and determining repair of crankshaft - Checking and determining repair of connecting rods - Checking and determining repair of pistons, rings, and piston pins - Checking and determining repair of flywheel and engine balance shafts - Writing technical report of the achieved done job	
		Direct observation (practical performance) Oral questions

Detailed Practical Course		
Hours	Content	Evaluation Tools
18	<p><b>Vehicle engine reassembly and reinstallation in the vehicle:</b></p> <p>(The trainees should consider replacement of all gaskets and oil seals during reassembly and consider the required tightening torque for bolts in accordance with values given in service and maintenance manual)</p> <ul style="list-style-type: none"> <li>- Reassembling cylinder head and adjusting the required clearances (in reverse order to the disassembly process)</li> <li>- Preparing cylinder block and reassembling its components and adjusting the required clearances (in reverse order to the disassembly process)</li> <li>- Reassembling cylinder head and block together (considering order of tightening bolts in conformation with service and maintenance catalogue)</li> <li>- Installing lubrication and cooling systems after checking and repairing what is required (oil pump and filter, water pump, thermostat)</li> <li>- Installing timing set</li> <li>- Completing the installation of engine accessories</li> <li>- Installing the engine in its place in the vehicle after replacement of engine mounts if needed</li> <li>- Connecting engine accessories connections</li> <li>- Adjusting engine in the vehicle (repair or replace what is required in the systems related to engine operation and starting of the engine after filling lubricating oil)</li> <li>- Softening the engine</li> <li>- Replacing engine oil and filter</li> <li>- Testing the engine on the chassis dynamometer</li> </ul>	



**References:**

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- 2- Heinze Heisler, "Advanced Engine Technology", Edward Arnold, ISBN 0340568224
- 3- William H. Crouse and Donald L. Anglin, "Automotive Mechanics" The McGrawHill Book Company, ISBN 0-02-800943-6
- 4- Jay Webster, Clifton E. Owen, "Basic Automotive Service & Repair", Delmar Publishers, 2000, ISBN 0-8273-8544-7
- 5- Don Knowles, "Automotive Technician Certification-Test Preparation Manual", Delmar Publishers, 2001, ISBN 0-7668-1948-5
- 6- Colin R. Ferguson, "Internal Combustion Engines", JOHN WILEY & SONS, 1986, ISBN 0-471-88129-5
- 7- A. Graham Bell, "Modern Engine Tuning", Haynes, 1997, ISBN 0-85429-987-5
- 8- Manufacturer's data and repair manuals
- 9- Martin, W. Stokel and Martin "Auto Mechanics Fundamentals", The GoodheartWillcox company, INC, ISBN 1-56637-138-4, 1996
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- 13- Jack Enjavec "Automotive Technology", Delmar Publishers, 2000, ISBN 0-7668-0673-1
- 14- Jack Enjavec, Robert Scharff, "Automotive Technology", Delmar Publishers, 1992, ISBN 0-8273-6724-4
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|  | <p>18- Crouse – Anglin, “Automotive Mechanics” - 10<sup>th</sup> Edition, The McGraw-Hill Book Company, 2000, ISBN 0-02-800943-6</p> <p>19- William H. Crouse and Donald L. Anglin, “The Auto Book” – 3<sup>rd</sup> Edition, The McGraw-Hill Book Company, 1984, ISBN 0-07-014571-7</p> <p>20- William H. Crouse and Donald L. Anglin, “Automotive Technician’s Handbook”, The McGraw-Hill Book Company, ISBN 0-07074751-5</p> |
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Department	Mechanical Technology	Major	Engines and Vehicles					
Course name	Suspension and Steering Systems.	Code	254 MEV					
Prerequisite	163 MEV							
<b>Course description:</b> Training in this course covers service, maintenance and repair of conventional and modern suspension and steering systems after performing the required checks and tests, with training on the use of service and maintenance catalogue, and the use of tools and equipment.								
		Trimester		1	2	3	4	5
		Credit hours					4	
		Contact hours	L				2	
W					4			
T					-			
<b>General course objective:</b> The course aims at giving the trainees the basic skills required to deal with the conventional and modern suspension and steering systems through carrying out inspections and tests using common equipment found in the automotive field, and to perform maintenance, repair, and replacement of faulty parts of these systems.								
Detailed Objectives		Required Performance Specifications			Related Tasks			
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Determine the type of suspension or steering system he is dealing with.  2) Check the conventional and modern suspension and steering systems.  3) Repair the components of conventional and modern suspension and steering systems.  4) Replace the components of conventional and modern suspension and steering systems.		 - The system and its type is one of the known systems used in vehicles  - Inspection steps conform with required specifications  - Repair steps conform with required specifications  - Replacement steps conform with required specifications			 <b>G1</b>  <b>G2..G16</b>  <b>K1, K3, K4, K8, K18</b>  <b>K2, K5..K7, K9, K10, K12, K13..K16, K19</b>			

<p>5) Adjust the steering wheel and balance the wheels.</p> <p>6) Differentiate between the different types of wheels and rims.</p> <p>7) Align wheel angles.</p> <p>8) Prepare report about the job done in the field of maintenance and repair suspension and steering systems.</p>	<p>- Adjustment of steering wheel, and balancing the wheels conform with required specifications</p> <p>- Aligning the wheels according to the values given in service and maintenance catalogue</p> <p>- Prepare reports that conform to specifications of technical reports preparation.</p>	<p><b>K17</b></p> <p><b>K11</b></p> <p><b>K20</b></p>
<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <p>1) Choose suitable place and position in the shop and put suitable protective shields on vehicle</p> <p>2) Remove some parts correctly if required.</p> <p>3) Select suitable cleaning material and clean parts for repaired</p> <p>4) Determine required spare parts.</p> <p>5) Follow up manufacturer instructions when performing maintenance and repair operations.</p>	<p>- Preparation of suitable work environment</p> <p>- Correct use of tools and equipment</p> <p>- Follow manufacturer instructions in selecting cleaning material and performing cleaning</p> <p>- Specifying spare parts according to specifications</p> <p>- Arrangement of maintenance and repair operations in accordance with manufacturer's specifications and special instructions</p>	<p><b>C1, C2</b></p> <p><b>B6</b></p> <p><b>C3, C4</b></p> <p><b>B8</b></p> <p><b>C5</b></p>
<p><b>Safety Requirements:</b></p> <ul style="list-style-type: none"> <li>- Complete compliance with safety instructions in automotive shops.</li> <li>- Take necessary precautions when dealing with the springs and the high pressure of hydraulic circuits and when using lifts.</li> </ul>		

Subjects (Theoretical and Practical)	Related Tasks	
<ul style="list-style-type: none"> <li>- Suspension and steering system operation fundamentals.</li> <li>- Front and rear suspension systems and their components (conventional and modern systems)</li> <li>- Conventional and modern steering systems, their components – tyres and rims</li> <li>- Special tools and equipment used to maintain and repair conventional and modern suspension and steering systems</li> <li>- Locating faults in conventional and modern suspension and steering systems</li> <li>- Repair, maintenance, and replacement of components and parts of conventional and modern suspension and steering systems</li> <li>- Method of preparing technical reports about the job done</li> </ul>	<b>G1</b>	- Identify the type of suspension system (hydraulic, air, mechanical)
	<b>G1</b>	- Identify the type of suspension system (hydraulic, air, mechanical)
	<b>B5</b>	- Use test equipment to determine car faults
	<b>G2..G16</b>	- All tasks related to the duty: Determine faults in steering and suspension systems
	<b>K1..K19</b>	- All tasks related to the duty: Repair mechanical faults in steering and suspension systems
	<b>K20</b>	- Fill in the final job sheet

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Fundamentals of suspension and steering systems operation:</b> <ul style="list-style-type: none"> <li>- The need for suspension systems in vehicles</li> <li>- Suspension system evolution</li> <li>- Components of the modern suspension system               <ul style="list-style-type: none"> <li>- Front suspension components</li> <li>- Rear suspension components</li> </ul> </li> <li>- Electronic control in suspension systems</li> <li>- The need of steering systems in vehicles</li> <li>- Steering system evolution</li> <li>- Steering system components               <ul style="list-style-type: none"> <li>- Conventional steering systems</li> <li>- Power steering systems</li> <li>- Steering of four-wheel drive vehicles</li> </ul> </li> <li>- Electronic control in steering systems</li> <li>- Vehicle chassis and bodies               <ul style="list-style-type: none"> <li>- Separate chassis and body</li> <li>- Integral chassis and body</li> <li>- Centre of gravity</li> <li>- Front wheel drive</li> <li>- Rear wheel drive</li> <li>- Four wheel drive</li> </ul> </li> </ul>	Written questions Oral questions Self test
2	<b>General components of suspension systems:</b> <ul style="list-style-type: none"> <li>- Springs               <ul style="list-style-type: none"> <li>- Function of the spring</li> <li>- Spring operation</li> <li>- Spring oscillation</li> <li>- Spring rate</li> </ul> </li> <li>- Types of springs               <ul style="list-style-type: none"> <li>- Coil springs</li> <li>- Leaf springs</li> <li>- Torsion bars</li> <li>- Air springs</li> </ul> </li> <li>- Shock absorber:               <ul style="list-style-type: none"> <li>- Function of the shock absorber</li> <li>- Shock absorber operation</li> <li>- Shock absorber fastening ends</li> <li>- Different types of shock absorbers and the difference</li> </ul> </li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
	between them: - Conventional shock absorber - Gas filled shock absorber - Adjustable type air shock absorber - Differences between the different types of shock absorbers - Shock absorber valves - Control arms: - Control arms with two fastening points - Control arms with one fastening point - Universal joints: - Drive shafts joints - Non-drive shafts joints - Ball joints: - Ball joints lubrication - Loading of ball joints - bushings: - Torsional bushings - Compression bushings - Stabilizer bars	
2	<b>Front suspension systems:</b> - Function of front suspension - McPherson front suspension system - Upper fastening point for the system - Lower fastening point for the system - Other parts of the system components - Differences between different designs of McPherson suspension - Independent conventional front suspension systems - Design of short arm suspension system - Difference between independent suspension systems - Dead axle front suspension systems (solid axle and I beam axle) - Ball joints and king pin - Solid axle front suspension system - Dual axle I-beam front suspension systems - Ball joints loading - In McPherson suspension - In conventional suspension - In dual solid axles suspension and dual I-beam suspension	Written questions Oral questions Self test

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
2	<b>Rear suspension systems:</b> <ul style="list-style-type: none"> <li>- Function of the rear suspension system</li> <li>- Types of rear suspension systems</li> <li>- Solid rear axles: <ul style="list-style-type: none"> <li>- Solid non-drive axles: <ul style="list-style-type: none"> <li>- Stabilizer and control arms designs</li> <li>- Leading and trailing arms</li> </ul> </li> <li>- Solid drive axles: <ul style="list-style-type: none"> <li>- Stabilizer and control arms designs</li> <li>- Drive solid axle springs: <ul style="list-style-type: none"> <li>- Coil springs</li> <li>- Leaf springs</li> </ul> </li> </ul> </li> </ul> </li> <li>- Independent rear axles: <ul style="list-style-type: none"> <li>- Independent non-drive axles</li> <li>- Compression and stabilizer bars</li> <li>- Non-drive axle springs: <ul style="list-style-type: none"> <li>- Coil springs</li> <li>- Transverse leaf springs</li> </ul> </li> <li>- Stabilizer bars</li> </ul> </li> <li>- Independent drive axles: <ul style="list-style-type: none"> <li>- Stabilizer and control arms designs</li> <li>- Independent drive axle springs: <ul style="list-style-type: none"> <li>- Coil springs</li> <li>- Transverse leaf springs</li> </ul> </li> </ul> </li> <li>- Semi-independent rear axle</li> <li>- Pneumatic adjustable type rear axles: <ul style="list-style-type: none"> <li>- Methods of manual or automatic air supply</li> </ul> </li> </ul>	Written questions Oral questions Self test



Detailed Theoretical Course		
Hours	Content	Evaluation Tools
5	<b>Steering systems:</b> <ul style="list-style-type: none"> <li>- Function of the steering system in the vehicle</li> <li>- General parts of the steering system: <ul style="list-style-type: none"> <li>- The steering wheels: <ul style="list-style-type: none"> <li>- Dimensions of steering wheels</li> <li>- Steering wheel linkages</li> </ul> </li> <li>- Warning sound switch and air bag</li> <li>- Steering columns: <ul style="list-style-type: none"> <li>- Column design</li> <li>- Steering couplings</li> <li>- Steering joints</li> <li>- Steering column assembly design</li> <li>- Adjustable steering column</li> </ul> </li> <li>- Steering arms and locations of ball joints</li> </ul> </li> <li>- Steering system types: <ul style="list-style-type: none"> <li>- Steering ratio</li> <li>- Different steering systems</li> <li>- Conventional steering systems</li> <li>- Power steering systems: <ul style="list-style-type: none"> <li>- Controlling pressure</li> <li>- Rack and pinion power steering</li> <li>- Conventional linkage type power steering</li> </ul> </li> <li>- Power steering of four wheel-drive vehicles: <ul style="list-style-type: none"> <li>- Hydro-electronic steering</li> <li>- Electromechanical steering</li> </ul> </li> </ul> </li> </ul>	Written questions Oral questions Self test
5	<b>Wheels, tyres, and wheel alignment angles:</b> <ul style="list-style-type: none"> <li>- Components of wheels: <ul style="list-style-type: none"> <li>- Designs and types of wheel bearings and methods of lubrication</li> <li>- Wheel hub and axle flange</li> <li>- Disc wheels (rims); construction, dimensions, and designation</li> <li>- Rubber tyre construction</li> <li>- Tyre dimensions and designation</li> <li>- Types of rubber tyres</li> </ul> </li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Tyre quality</li> <li>- Means of wheel installation</li> <li>- Wheel alignment angles               <ul style="list-style-type: none"> <li>- Importance of wheel inclination</li> <li>- Types of wheel inclinations</li> <li>- Wheel inclination angles</li> <li>- Methods used in adjusting wheel inclination angles</li> <li>- Adjustment of wheel alignment angles</li> </ul> </li> <li>- Position of steering wheel</li> <li>- Non-adjustable wheel angles</li> <li>- Wheel angles interrelationship</li> <li>- Factors affect wheel alignment</li> </ul>	Written questions Oral questions Self test
4	<b>Electronic suspension and steering systems:</b> <ul style="list-style-type: none"> <li>- Fundamentals of electronic suspension system:               <ul style="list-style-type: none"> <li>- Input sensors and switches</li> <li>- Electronic control unit</li> <li>- Out put devices</li> </ul> </li> <li>- Types and components of electronic suspension systems:               <ul style="list-style-type: none"> <li>- Vehicle leveling sensitive system</li> <li>- Vehicle speed sensitive system</li> <li>- Hydraulic damping systems</li> <li>- Combined systems</li> </ul> </li> <li>- Steering electronic control systems and components:               <ul style="list-style-type: none"> <li>- Components of electronic control system</li> <li>- Electronic control system operation</li> </ul> </li> <li>- Electronically controlled steering and suspension systems faults</li> </ul>	
2	<b>Methods of locating faults in suspension and steering systems:</b> <ul style="list-style-type: none"> <li>- Importance of systematic approach of locating faults</li> <li>- Fault diagnosis strategy</li> <li>- Diagnosing faults causing noise and vibrations</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
2	<b>Method of applying safety instructions in automotive workshop:</b> <ul style="list-style-type: none"> <li>- Methods of applying general instructions</li> <li>- Practical applications of instructions on automotive maintenance and repair workshops when starting practical training of the course</li> </ul>	Direct observation (practical performance) Oral questions Case studies
6	<b>Identification of conventional and modern suspension and steering systems components and parts:</b> <ul style="list-style-type: none"> <li>- Identification of different types of suspension systems</li> <li>- Identification of different types of steering systems</li> <li>- Identification of the components of conventional and modern suspension and steering systems</li> <li>- Identification of the difference between system's components of different suspension systems according to the type of vehicle drive</li> <li>- Identification of electronically controlled suspension systems</li> <li>- Identification of the conventional and power steering system components</li> <li>- Identification of the difference between the components of different steering systems according to the method of vehicle drive</li> <li>- Identification of electronically controlled steering systems</li> <li>- Difference between chassis and body positions (separate or integral)</li> </ul>	
4	<b>Identification of the tools and equipment used for maintaining and repairing suspension and steering systems, and the methods of using them:</b> <ul style="list-style-type: none"> <li>- Basic tools</li> <li>- Special tools for tyres, disc wheels, and bearings</li> <li>- Operating tools</li> <li>- Special tools for power steering systems</li> <li>- Special tools for adjusting wheel alignment angles</li> <li>- Electronic end electrical testing equipment</li> <li>- Measuring tools</li> <li>- Equipment for maintaining and repairing suspension and steering systems</li> <li>- Writing technical report of the job done</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
6	<b>Maintenance and repair of front suspension systems:</b> <ul style="list-style-type: none"> <li>- Checking and testing front suspension system (concerning vibrations, noise, and tyre wear...etc)</li> <li>- Checking and testing front suspension system components               <ul style="list-style-type: none"> <li>- Visual inspection</li> <li>- Manual checking</li> <li>- Checking using measuring tools</li> <li>- Quick inspection</li> <li>- Accurate inspection</li> </ul> </li> <li>- Replacement of front suspension system components               <ul style="list-style-type: none"> <li>- Testing parts to be replaced</li> <li>- Replacement of shock absorber assembly</li> <li>- Replacement of ball joints with different types</li> <li>- Replacement of control arms and bushings</li> <li>- Replacement of solid axle and I-beam dual axles and their bushings</li> <li>- Replacement of stabilizer arms and bushings</li> <li>- Replacement of coil springs</li> <li>- Replacement of torsion bars</li> <li>- Servicing the king pin</li> </ul> </li> <li>- Writing technical report of the job done</li> </ul>	Direct observation (practical performance) Oral questions Case studies
8	<b>Maintenance and repair of rear suspension systems:</b> <ul style="list-style-type: none"> <li>- Checking and testing rear suspension system (concerning vibrations, noise, and tyre wear...etc)</li> <li>- Checking and testing rear suspension system components               <ul style="list-style-type: none"> <li>- Visual inspection</li> <li>- Manual checking</li> <li>- Checking shock absorber and parts</li> <li>- Checking air shock absorber and control system</li> <li>- Checking operation of control compressor</li> <li>- Checking control valve operation</li> </ul> </li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Replacement of rear suspension system components               <ul style="list-style-type: none"> <li>- Replacement of McPherson type suspension system and shock absorber</li> <li>- Replacement of control and stabilizer arms</li> <li>- Replacement of ball joints</li> <li>- Replacement of springs:                   <ul style="list-style-type: none"> <li>- Coil springs</li> <li>- Transverse leaf springs</li> <li>- Longitudinal leaf springs</li> <li>- Torsion bars</li> </ul> </li> <li>- Servicing non-drive rear axles</li> <li>- Servicing drive rear axles</li> <li>- Addition of auxiliary leaf springs</li> <li>- Replacement of solid rear axle assembly                   <ul style="list-style-type: none"> <li>- Non-drive axles</li> <li>- Drive axles</li> <li>- Suspending leaf springs</li> <li>- Suspending coil springs</li> </ul> </li> <li>- Servicing air shock absorber and control systems                   <ul style="list-style-type: none"> <li>- Replacement of air shock absorber</li> <li>- Replacement of components of air control system and air paths</li> <li>- Addition of air shock absorber to a vehicle</li> </ul> </li> </ul> </li> <li>- Writing technical report of the job done</li> </ul>	<p>Direct observation (practical performance) Oral questions Case studies</p>
6	<p><b>Maintenance and repair of conventional steering gear boxes and steering linkages:</b></p> <ul style="list-style-type: none"> <li>- Checking and testing steering system (concerning vibrations, noise, tyre wear, hard steering, steering loss, oil leakage...etc)               <ul style="list-style-type: none"> <li>- Checking steering effort</li> <li>- Checking and testing steering wheels and shafts                   <ul style="list-style-type: none"> <li>- Checking noise</li> <li>- Checking loose connections</li> </ul> </li> <li>- Checking and testing steering linkages                   <ul style="list-style-type: none"> <li>- Visual inspection</li> <li>- Manual inspection</li> </ul> </li> </ul> </li> <li>- Checking and testing steering box</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Maintenance and repair of steering system components               <ul style="list-style-type: none"> <li>- Maintenance and repair of steering wheel and steering shafts</li> <li>- Stopping operation of air bag</li> <li>- Replacement of steering wheel and air bag</li> <li>- Replacement of steering shaft parts                   <ul style="list-style-type: none"> <li>- Internal parts of the shaft</li> <li>- Parts of the shaft lower end</li> </ul> </li> <li>- Replacement of steering shaft coupling and universal joint</li> <li>- Replacement of steering shaft and reconnection of the air bag circuit</li> <li>- Replacement of steering linkages</li> </ul> </li> <li>- Maintenance and repair of conventional steering box               <ul style="list-style-type: none"> <li>- Addition of steering oil to the steering gear box</li> <li>- Adjustment of rack and pinion type steering gear box</li> <li>- Replacement of rack and pinion type steering gear box</li> <li>- Carrying out complete overhaul to rack and pinion type steering gear box</li> <li>- Adjustment of conventional steering gear box</li> <li>- Adjustment of gear teeth clearances</li> <li>- Reloading worm gear spring</li> <li>- Replacement of conventional steering gear box</li> <li>- Carrying out complete overhaul to conventional steering gear box</li> </ul> </li> <li>- Writing technical report of the job done</li> </ul>	<p>Direct observation (practical performance) Oral questions Case studies</p>
6	<p><b>Maintenance and repair of power steering systems and four wheel drive steering systems:</b></p> <ul style="list-style-type: none"> <li>- Checking and testing power steering gear box (concerning vibrations, noise, tyre wear, hard steering, steering loss, oil leakage...etc)               <ul style="list-style-type: none"> <li>- Maintenance of power steering box</li> </ul> </li> <li>- Checking and testing power steering box               <ul style="list-style-type: none"> <li>- Checking steering effort</li> <li>- Checking noise</li> <li>- Visual inspection</li> <li>- Checking condition of drive belt</li> </ul> </li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Checking leakage of steering oil</li> <li>- Checking and testing pressure of steering oil</li> <li>- Testing power steering systems in four-wheel drive vehicles</li> <li>- Maintenance and repair of power steering system components               <ul style="list-style-type: none"> <li>- Adjustment and replacement of drive belt and pulley</li> <li>- Replacement of oil cooler</li> <li>- Replacement of steering pump</li> <li>- Replacement of steering gear box</li> <li>- Comprehensive repair of steering gear box                   <ul style="list-style-type: none"> <li>- Rack and pinion type steering gear box</li> <li>- Conventional steering box</li> <li>- Linkage type steering box</li> </ul> </li> <li>- Disassembly and repair of control valve</li> <li>- Disassembly and repair of power cylinder</li> <li>- Maintenance and repair of rear power steering gear box</li> <li>- Maintenance and repair of power steering gear box in four-wheel drive vehicles</li> <li>- Replacement of tie rod ends</li> <li>- Replacement of parts related to power steering system                   <ul style="list-style-type: none"> <li>- Electrical units</li> <li>- Hydraulic control units</li> </ul> </li> <li>- Air bleeding from power steering systems</li> </ul> </li> <li>- Writing technical report of the job done</li> </ul>	Direct observation (practical performance) Oral questions Case studies
4	<b>Maintenance and repair of tyres, wheels, and adjustment of wheel alignment angles:</b> <ul style="list-style-type: none"> <li>- Checking and testing balance of drive shaft</li> <li>- Checking wheel components               <ul style="list-style-type: none"> <li>- Checking faults in wheel bearings and oil seals</li> <li>- Checking faults in wheel hub and axles flange</li> <li>- Checking faults in disc wheels (rims)</li> <li>- Checking faults in rubber tyres</li> </ul> </li> <li>- Maintenance and repair of wheel components               <ul style="list-style-type: none"> <li>- Servicing wheel bearings (dismantling, cleaning, replacing, and lubricating bearings)</li> <li>- Maintenance and repair of disc wheels (rims)</li> <li>- Maintenance and repair of rubber tyres</li> <li>- Wheel balancing (on the vehicle and separately)</li> <li>- Tyre rotation on the vehicle</li> </ul> </li> <li>- Alignment of wheel angles</li> <li>- Writing technical report of the job done</li> </ul>	

Detailed Practical Course		
Hours	Content	Evaluation Tools
6	<b>Maintenance and repair of electronic suspension and steering systems:</b> <ul style="list-style-type: none"> <li>- Retrieving fault codes</li> <li>- Interpretation of fault codes</li> <li>- Checking and testing the system regarding electrical problems</li> <li>- Using diagnostic maps</li> <li>- Checking and testing electronically controlled suspension system components</li> <li>- Maintenance and repair of the electronically controlled suspension system components <ul style="list-style-type: none"> <li>- Adjustment and replacement of system components</li> </ul> </li> <li>- Checking and testing electronically controlled steering system components</li> <li>- Maintenance and repair of the electronically controlled steering system components <ul style="list-style-type: none"> <li>- Adjustment and replacement of system components</li> </ul> </li> <li>- Writing technical report of the job done</li> </ul>	Direct observation (practical performance) Oral questions Case studies



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Department	Mechanical Technology	Major	Engines and Vehicles																																
Course name	Automotive Fault diagnosis	Code	264 MEV																																
Prerequisite	172 MEV																																		
<b>Course description:</b> This course covers the principals of mechanical fault diagnosis of vehicles, and the methods of using testing equipment to determine theses faults through setting up diagnostic strategy. In addition, it includes methods of checking vehicles and diagnosing their faults in accordance with the manufacture’s manual for each vehicle model, besides diagnosing basic electrical faults in vehicles. The course also includes different applications on vehicle problems found in many vehicle systems, and the causes of faults and methods of diagnosing these faults and the equipment used.			<table><tr><td>Trimester</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Credit hours</td><td></td><td></td><td></td><td></td><td>5</td></tr><tr><td rowspan="3">Contact hours</td><td>L</td><td></td><td></td><td></td><td>2</td></tr><tr><td>W</td><td></td><td></td><td></td><td>6</td></tr><tr><td>T</td><td></td><td></td><td></td><td>-</td></tr></table>					Trimester	1	2	3	4	5	Credit hours					5	Contact hours	L				2	W				6	T				-
Trimester	1	2	3	4	5																														
Credit hours					5																														
Contact hours	L				2																														
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<b>General course objective:</b> The course aims at giving trainees the basic skills to diagnose mechanical and basic electrical faults in vehicles using testing and diagnostic equipment, by follow manufacturer manual procedure for each vehicle, with the applications of different problems found in many vehicle systems, causes of their faults, and methods of diagnosing using suitable equipment.																																			
Detailed Objectives			Required Performance Specifications			Related Tasks																													
<b><u>First: Procedural Objectives:</u></b> <b>The trainees should be able to:</b>  1) Fill in inspection sheet  2) Explain systematic procedures for inspections.  3) Diagnose vehicle faults using his senses (eye – ear –smell).  4) Use special inspection and measuring tools for vehicle components.			 - Ability to fill in inspection sheet   - Ability to diagnose mechanical and electrical faults   - Using different inspection and testing equipment in accordance with manufacturer’s recommendations			 <b>H7, A9</b>  <b>B2, B3</b>  <b>E6, B5</b>  <b>D6, E7</b>																													

5) Follow checking and testing procedures in accordance with vehicle manufacturer manuals.	- Follow testing and diagnostic procedures according to recommendations	<b>C5</b>
<p><b><u>Second: Auxiliary Objectives (Cognitive and Behavioral):</u></b>  <b>The trainees should be able to:</b></p> <ol style="list-style-type: none"> <li>1) Show awareness of the fundamentals of mechanical fault diagnosis, and vehicle basic electrical faults.</li> <li>2) Show awareness of applications on different vehicle system problems and the causes of their faults.</li> <li>3) Identify the inspection sheet form and method of filling it in.</li> </ol>	<ul style="list-style-type: none"> <li>- Explanation of the fundamentals of fault diagnosis</li> <li>- Naming different problems causes and faults in vehicle systems</li> <li>- Ability to fill in inspection sheet</li> </ul>	<b>B2, B3, B4, B5, D6, E7, H7</b>
<p><b>Safety Requirements:</b></p> <ul style="list-style-type: none"> <li>- Compliance with safety instructions found in automotive workshops.</li> <li>- Follow the required precautions when dealing with equipment and electronic circuits.</li> </ul>		
<b>Subjects (Theoretical and Practical)</b>	<b>Related Tasks</b>	
<ul style="list-style-type: none"> <li>- Listening to and analyzing of the complaint of the vehicle owner</li> <li>- Fundamentals of fault diagnosis and the use of different testing equipment</li> <li>- Checking conformance with manufacturer and determining faults.</li> <li>- Different vehicle faults (inspections and methods of repair)</li> </ul>	<b>B1</b>	- Query car user about car problems
	<b>B2, B3, B5, D6, E7</b>	<ul style="list-style-type: none"> <li>- visually inspect the car</li> <li>- check the car while driving and stopping</li> <li>- Use test equipment to determine car faults</li> <li>- Measure engine compression pressure</li> <li>- Use testing equipment</li> </ul>
	<b>C5</b>	- Follow manufacturer instructions for periodic maintenance
	<b>All tasks in duties D, E, F, G, E6</b>	<ul style="list-style-type: none"> <li>- Determine faults in engine and different vehicle systems</li> <li>- determine types of faults (electrical, mechanical, hydraulic)</li> </ul>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
3	<b>Vehicle fault diagnosis:</b> <ul style="list-style-type: none"> <li>- Criteria of receiving the vehicle from the customer</li> <li>- Types of service and maintenance catalogues and methods of using them</li> <li>- Identification of vehicle identification number (VIN)</li> <li>- Different methods of vehicle fault diagnosis (eye – ear – smell – using equipment)</li> <li>- Special forms used in vehicle fault diagnosis and method of filling them in</li> <li>- Vehicle fault diagnosis and repair strategy</li> <li>- Method of writing technical reports about vehicle fault diagnosis and repair</li> </ul>	Written questions Oral questions Self test
3	<b>Diagnosing faults in vehicle engines:</b> <ul style="list-style-type: none"> <li>- Diagnosing fault in vehicle engines and its related systems (mechanical or electrical fault) using the necessary tools and equipment after performing tests to determine engine condition</li> <li>- Identification of the methods of inspecting and diagnosing engine condition using (oil color, vibrations, exhaust color, and sounds)</li> <li>- Determination of the required maintenance and repair of vehicle engines that eliminate faults.</li> <li>- Reexamination of the vehicle engine to ensure disappearance of the fault</li> <li>- Common faults in vehicle engines (gasoline/diesel) and their causes</li> </ul>	
5	<b>Diagnosing faults in engine systems:</b> <ul style="list-style-type: none"> <li>- Common faults in cooling systems and their causes</li> <li>- Common faults in lubrication systems and their causes</li> <li>- Common faults in intake and exhaust systems and their causes</li> <li>- Common faults in ignition systems and their causes</li> <li>- Common faults in the fuel system (gasoline/diesel) and their causes</li> <li>- Common faults in the starting system and their causes</li> <li>- Common faults in the charging system and their causes</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<p><b>Diagnosing faults in power transmission systems:</b></p> <ul style="list-style-type: none"> <li>- Diagnosing faults of the clutch and identification of their causes               <ul style="list-style-type: none"> <li>- Sources of noise arises during operation</li> <li>- Smells resulted from clutch burning and their causes</li> <li>- Causes of hard or delay of shift</li> <li>- Effect of clutch pedal free travel on the clutch performance</li> <li>- Method of measuring clutch pedal free travel</li> </ul> </li> <li>- Diagnosing faults in sliding mesh gear boxes and identification of their causes               <ul style="list-style-type: none"> <li>- Sources of noise arises during operation</li> <li>- Causes of hard or disengaging shifting</li> <li>- Causes and symptoms of oil leakage</li> </ul> </li> <li>- Diagnosing faults of automatic transmissions and identification of their causes               <ul style="list-style-type: none"> <li>- Methods of checking and diagnosing transmission condition through the condition of transmission oil</li> <li>- Causes and symptoms of oil leakage</li> <li>- Methods of measuring pressures inside the automatic transmission</li> <li>- Methods of checking mechanical and vacuum linkages and the electrical connections</li> <li>- Method of testing the transmission using vehicle brakes</li> <li>- Faults of oil cooler; their causes and methods of corrections</li> </ul> </li> <li>- Diagnosing faults in propeller and drive shafts, and identification of their causes               <ul style="list-style-type: none"> <li>- Sources of noise arises during operation</li> <li>- Methods of manual checking of propeller shaft after placing the vehicle on the lift</li> <li>- Method of checking bending in the propeller shaft</li> </ul> </li> <li>- Diagnosing faults in final drive gears (differential), and identification of their causes               <ul style="list-style-type: none"> <li>- Sources of noise arises during operation</li> <li>- Causes and results of the loss of rear axle oil</li> <li>- Clearance of final drive gears (causes and symptoms)</li> </ul> </li> </ul>	<p>Written questions Oral questions Self test</p>

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Diagnosing faults in drive axles and identification of their causes</li> <li>- Diagnosing faults in different types of joints (checking clearance) and identification of their causes</li> <li>- Diagnosing faults in bearings and identification of their causes</li> <li>- Common faults in the vehicle power transmission system and identification of their causes</li> </ul>	<p>Written questions Oral questions Self test</p>
3	<p><b>Diagnosing faults in suspension and steering systems and tyres:</b></p> <ul style="list-style-type: none"> <li>- Methods of manual checking suspension components (springs, shock absorber, ball joints)</li> <li>- Causes and symptoms of faults in conventional and modern suspension systems and their causes</li> <li>- Checking components of different steering systems (conventional – power) and the causes and symptoms of faults in: <ul style="list-style-type: none"> <li>- Steering linkages</li> <li>- Steering gear box</li> <li>- Steering pump</li> <li>- Ball joints</li> <li>- Steering shafts and arms</li> <li>- Steering wheel and air bag</li> <li>- Main steering shaft</li> <li>- Torsion bars</li> </ul> </li> <li>- Checking tyre condition <ul style="list-style-type: none"> <li>- Causes and symptoms of tyre wear</li> <li>- Effect of pressure variations in the tyres on their performance</li> <li>- Causes of wheel bearings damage</li> <li>- Wheel alignment angles and the results of not adjusting them</li> </ul> </li> <li>- Common faults in conventional and modern suspension systems</li> <li>- Common faults in conventional and modern steering systems</li> <li>- Common faults in tyres and wheel angles</li> </ul>	

Detailed Theoretical Course		
Hours	Content	Evaluation Tools
4	<b>Diagnosing faults in brake systems:</b> <ul style="list-style-type: none"> <li>- Methods of checking brake pedal travel</li> <li>- Methods of checking brake booster</li> <li>- Methods of checking the hydraulic systems</li> <li>- Methods of checking condition of parking brakes</li> <li>- Methods of checking wheel brakes</li> <li>- Methods of checking brake performance during driving</li> <li>- Common faults in brake systems and their causes</li> <li>- Common faults in anti-lock brake system and their causes</li> </ul>	Written questions Oral questions Self test
4	<b>Diagnostic equipment and fault tracing charts:</b> <ul style="list-style-type: none"> <li>- Types of fault tracing charts</li> <li>- Methods of using charts to detect faults</li> <li>- Manual inspection tools (pressure – current – resistance...etc)</li> <li>- Vehicle on-board diagnostic systems (OBD-I, OBD-II)</li> <li>- Modern testing equipment (scan tools) used to detect faults in electronic systems in the vehicle (selecting suitable equipment – reading of fault codes – using maintenance manuals)</li> <li>- Using simulation programs</li> </ul>	



Detailed Practical Course		
Hours	Content	Evaluation Tools
6	<b>Fault diagnosis workshop:</b> <ul style="list-style-type: none"> <li>- Safety rules and instructions in fault diagnosis workshops, including all branches of automotive workshops used to diagnose faults according to faulty systems</li> <li>- Determination of places of special tools and service and maintenance manuals for different vehicle types and models</li> <li>- Identification of the different repair sheets of the automotive shops, and training on how to fill them in</li> <li>- Training on how to receive the vehicle from the customer and method of filling the reception sheet</li> <li>- External checking of the vehicle (eye – ear – smell) using inspection card</li> <li>- Placing the vehicle on the lift and follow safety procedure during lifting, and method of securing the lift</li> </ul>	Direct observation (practical performance) Oral questions
6	<b>Diagnostic equipment:</b> <ul style="list-style-type: none"> <li>- Using manual inspection tools (pressure – current – resistance...etc)</li> <li>- Using vehicle on-board diagnostic systems (OBD-I, OBD-II)</li> <li>- Using modern scan tools to detect faults in vehicle electronic systems (selecting suitable equipment – reading of fault codes – using maintenance manuals)</li> <li>- Using simulation programs</li> </ul>	
14	<b>Diagnosing vehicle engine faults:</b> <ul style="list-style-type: none"> <li>- Checking and diagnosing engine conditions using (oil color – vibrations – exhaust color – sounds)</li> <li>- Identification of the set of equipment used in vehicle engine condition tests (compression test – vacuum test – compression leakage test – exhaust gas analysis – engine balance test – lubrication circuit test– cooling circuit test)</li> <li>- Applications of the previous items on some practice engines in the automotive workshop to determine their conditions</li> <li>- Writing technical report of the job done</li> </ul>	
6	<b>Diagnosing faults in air conditions, heating, and electrical circuits and determination of their conditions :</b>	Direct observation (practical performance) Oral questions

Detailed Practical Course		
Hours	Content	Evaluation Tools
	<ul style="list-style-type: none"> <li>- Diagnosing circuit faults</li> <li>- Diagnosing faults of circuit components and parts</li> <li>- Writing technical report of the job done</li> </ul>	
10	<b>Diagnosing faults in fuel and ignition circuits using special equipment:</b> <ul style="list-style-type: none"> <li>- Diagnosing circuit faults</li> <li>- Diagnosing faults of circuit components and parts</li> <li>- Writing technical report of the job done</li> </ul>	
12	<b>Diagnosing faults in suspension and steering systems and observation of any leakage, and the use of wheel alignment apparatus :</b> <ul style="list-style-type: none"> <li>- Diagnosing system faults</li> <li>- Diagnosing faults of the system components and parts</li> <li>- Writing technical report of the job done</li> </ul>	
12	<b>Diagnosing faults in brake systems and checking ABS components using special equipment:</b> <ul style="list-style-type: none"> <li>- Diagnosing system faults</li> <li>- Diagnosing faults of the system components and parts</li> <li>- Writing technical report of the job done</li> </ul>	
12	<b>Diagnosing faults in power transmission systems, manual and automatic transmissions, and the rear axle :</b> <ul style="list-style-type: none"> <li>- Diagnosing system faults</li> <li>- Diagnosing faults of the system components and parts</li> <li>- Writing technical report of the job done</li> </ul>	

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